DÆDALUS

Proceedings of the American Academy of Arts and Sciences

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Foreword

THIS FOURTH NUMBER, which concludes the first volume of *Dædalus*, completes the first stage in the journal's new evolution. In May 1955 I stated, with an excess of optimism, that "in its experimental stages *Dædalus* will appear at irregular intervals, as funds and contributions permit, with not less than two numbers in each calendar year." Actually it has taken two years and a half to bring out four numbers, due both to the tightness of funds and the shortage of free time on my part. It has become very clear that the papers read at the Academy's meetings do not furnish a sufficient supply of articles to permit *Dædalus* to appear at regular intervals. Of the nineteen articles in this volume, ten were read at Academy meetings while the remaining nine were scrounged from friends, chiefly – although not entirely – within the Academy.

At the annual meeting in May 1957 I exchanged the office of Editor for the Chairmanship of the House Committee, and so during the past five months have been chiefly concerned with the pleasant problem of settling the Academy offices and meetings into the spacious rooms of Faulkner Farm. My successor as Editor, Professor Gerald J. Holton, who has ambitious plans for the expansion of *Dædalus* that we all hope will lead to a journal of broad interest appearing at stated intervals, courteously accepted my offer to see through the press the articles already scheduled for publication. Thus the whole of volume 86 bears the names of a Publication Committee whose term has expired, and of an Editor whose responsibilities to the Academy now involve the hanging of pictures, caning of chairs, weeding of gardens and provision of food and drink. The second experimental stage of *Dædalus* will begin early next year when Professor Holton brings out the first number of volume 87.

Many readers, particularly among Fellows living at a distance who are rarely able to attend Academy meetings, have been so thoughtful as to express their pleasure in the earlier numbers of *Dædalus*. It has been an encouragement to hear from them, and a pleasure to work with the members of the Committee on Publication who played so useful a part in the transformation of the Academy's *Proceedings*. Harlow Shapley, who hit upon the name, Hudson Hoagland and Erwin Canham proved themselves the best of friends and allies. In

taking my leave as Editor, I must, however, pay particular tribute to Rudolph Ruzicka, not only for the design of *Dædalus* but for the constant and extraordinary help that he has given with its execution. Good printing can never be mass produced according to a set pattern, for, as Beatrice Warde has said, " the most important thing about printing is that it conveys thoughts, ideas, images, from one mind to other minds." To accomplish this conveyance happily and inconspicuously one must, as it were, cut one's goods not only according to the design of the uniform but the shape of the soldier to be clothed. In the matter of *Dædalus*, Rudolph Ruzicka has not only designed the uniform but has seen to it that its wearers have been neatly fitted in spite of the disparity of their shapes. The expiration of his term, according to the theory of rotation of committees under which the Academy now operates, will necessarily weaken the Publication Committee in technical matters of book design and production, for he has no equal within or without the Academy. The process of rotation is all very well when one has a number of equally eminent practitioners of the same discipline to choose from, but when one applies this principle to a man of unique qualifications, deterioration is the inevitable price paid for devotion to democracy. The end of Mr. Ruzicka's association with *Dædalus* thus becomes a matter of deep regret.

WALTER MUIR WHITEHILL
EDITOR

The Archaic Smile

The Relation of Art and the Dignity of Man

FRANCIS HENRY TAYLOR

FIFTY years ago archaic sculpture was known only as a curious phenomenon. It was assumed that all primitive peoples made statues in much the same spirit in which children make mud pies. No one but archaeologists – antiquarians and numismatists they were called then – bothered to look at these barbaric efforts in stone and clay. It was soon discovered, however, that savages worked in bronze. German professors with large watch chains and scrubby beards began to collect hairpins and cooking utensils. Civil servants with mouths agape beneath pith helmets learned that their preferment depended upon the number of curiosities they forwarded to the British Museum. The *boulevardiers,* who seldom left Paris and never under any circumstances went beyond Marseilles, were the first to be attracted by the beauty of these images. Such strange and sophisticated creations of remote antiquity were not only very fine to look upon but in some way seemed to be intimately connected with the artist's inner life. And primitive art moved into the drawing room.

Archaic sculpture is an art belonging to that period of man's religious development when the *idea* was as big and important as the forms which symbolized it. Moral values and concepts had not yet become established and a confusion existed between objects of reality and the world of the spirit. The rational and irrational were merged together and responded to physical and mental stimuli. Strange and occult powers were ascribed to rocks and trees, to events and natural phenomena. There was no part of material existence that was not bounded by taboo and superstition. Chance was completely unknown, as was the concept of nature as a thing apart; reality was a mystical experience and every action determined by participation rather than by natural law. Even the images and idols which man created had no individual actuality. They were at most transfer mechanisms through the means of which the portrait, for example, partook of the identity of its subject and the subject in turn acquired the characteristics of the portrait.

> There was a child went forth every day
> And the first object he looked upon and received with wonder, pity, love or dread, that object he became,
> And that object became part of him for the day, or a certain part of the day, or for many years, or stretching cycles of years. . . . [1]

The image in which the sculptor was living over again his own passions and experience was architectonic. Like a newborn baby, however awkward, it was nevertheless a fully created thing with definite relations between its parts; and like the average baby, remarkably self-contained.

A smile appears on the faces of most archaic figures, a happiness of expression seeming to transcend that of human beings. The almond shaping of the eyes, widespread upon the forehead, thick ribbon lids, and shelving brows give an impersonal dignity to their regard. The eyes are superb and proud, not vacant. There is a complete indifference to portraiture, a tranquility and resignation which is sometimes observed on the faces of dead persons. Not only in the treatment of the eyes are eliminations apparent but in the nostrils as well; placed above coarse cubic lips, they bring the flattened surfaces of the cheeks together between definite nose and chin. The jawbone continues the boundaries of a compact head set upon massive shoulders which are gradually welded into an organic trunk, immobile and majestic. The figure is built up step by step from the base on which it stands and of which it is a part.

Certainly the Greek of the sixth century B.C. did not observe such heroic individuals in his daily life. Yet one cannot dismiss these images as the product of inferior execution. The fact that the artist did not attempt the actual portraiture of those about him must be laid more to a sense of consecration within himself than to technical deficiency. His figures were conceived in immortality, and, since he had not inquired too closely into the character of his gods, he created ideal representations of them, generalizations of supermen, bearing none of the arresting peculiarities of actual persons. This was, of course, not destined to continue in the later and more classical periods of Hellenism.

[1] Walt Whitman, *Leaves of Grass*. See also Jean Pelseneer, *L'Évolution de la notion de phénomène physique des primitifs à Bohr et Louis de Broglie* (Brussels, 1947), and L. Lévy-Bruhl, *Les fonctions mentales dans les sociétés inférieures* (Paris, 1928).

By the time of Thales of Miletus, father of physical science, the dawn of formalized religion had arisen and a conscious disassociation of the material from the spiritual had already taken place. The power of inanimate things had been transferred to a pantheistic assembly of human or semihuman gods and goddesses who shared all the mortal vices but seldom tempered their divine authority with any virtue other than confusion. The Olympus of the Homeric poems had indeed become so complicated that a priesthood was essential to regulate the powers and influences of the several deities, to separate the sacred from the profane, the human from the semi-human, and to establish the personalities of heroes, gods, and mortals. Often a dualism of function and purpose was admitted; the sun and heavenly bodies were both human and divine. Even in those remote days we see emerge that omniscient anthropomorphism in which was consummated the ultimate union of the rational and the ethical. Plato and Aristotle were to hand this concept on as part of the theological foundation of the medieval church.

Every civilization has had its great period of archaic sculpture. In Egypt under the Memphite kings the Sphinx, whose smile is perhaps the greatest riddle of antiquity, was carved. Never has a people produced an art more instinct with dignity and reverence. A statue of the Pharaoh epitomizes not only the absolutism of his rank but the strangeness of his origin. The Nile which bore him alone might explain the mystery of his smile, a transfixed but scarcely humorous expression of his deity. In the early periods of Egyptian art his identity was revealed in nearly every instance by nothing more than an insignificant cartouche; yet the solemnity of the convention is rarely disturbed by the desire for portraiture. This convention asserts itself, moreover, in every art that derived its inspiration from the Egyptian. In Assyria and Babylonia, in Chaldea and Cyprus, even in Crete and the Aegean islands, the religious purposefulness of archaic art is combined with a stillness of the spirit which transcends the very existence of the individual who brought this conception into being.

In Italy a parallel progression took place in Etruscan art. No visitor to the Villa Giulia in Rome will resist the suavity of the early figures or the happiness in the faces of the effigies lying, half-raised upon one arm, on their terra cotta tombs. Borrowing their gods from the Greeks, the Etruscans gave them a new and terrible authority. All that is somber in the Latin temperament is revealed

in the uncompromising attitudes of the tomb paintings at Corneto and Cerveteri. Roman sculpture, on the other hand, reflected another point of view. It was immediate and finite, never knowing an archaic period, for the Latin mind was too filled with actuality. Roman gods were as regularly codified as Roman law, and the citizens of both the republic and the empire were inspired by little else than the acquisition of property and the steps necessary to retain it. Every religious statue dedicated by a citizen was a direct financial settlement with a divinity for a specific amount of grace or service rendered to the donor. Rome was the Chicago of antiquity and Roman law was based on the principle that it is better to buy off a god than to flatter him with prayer. That the Romans excelled in portraiture is therefore not surprising, for they were masters of the commonplace, and the portrait bust invariably spoke in the terms only of the limitations of the sitter, not of his potentialities.

Romanesque art, on the other hand, returns once again to the archaic as an expression of Romanesque religion. The sense of contract between man and his creator had been lacking in the earlier centuries of the Church, where at best the pagan tradition of the court was crudely imitated. The worship of the catacombs was a groveling affair, a brave attachment to a cause which defied the horrors of persecution and the hardships of its mission. Man had little time to speculate upon his relation to his divine author. Even the cleric, the most enlightened man of his day, was too busy carrying on the daily life of the Church to burden his mind with metaphysics. The year 1000 brought about a change in his point of view. Modern scholarship to the contrary, it seemed a convenient date at which the world might end; for medieval man, too, preferred round numbers. The Christian peoples prepared themselves for judgment. But, strangely enough, the world kept on and the spirit of inquiry which the excitement had provoked was directed into the pathway of monastic reform. During the twelfth and thirteenth centuries a wave of religious emotion swept over Europe. The Cluniac reform, inspired by St. Bernard of Clairvaux, brought about an intimacy between the monk and his Christ, the monk and the Blessed Virgin, not seen since the religions of primitive times. Sheltered from the world, and a sorry place it was if we believe the chronicles, the monk gave up his life to the contemplation of his God. Although to medieval man the details of Jesus' life were almost a commonplace, the individuality of Christ was not that of a mythological hero.

For the generality of his position as Savior of Mankind was uppermost; He was not only Jesus of Nazareth but the ideal of redemption as well, just as His Mother was the Mother of All Living in her dual role of wife to Joseph and Mother of the Son of God.

It was just this bigness of conception which was needed to produce Romanesque sculpture and why in it we find those qualities, even to the smile itself, which abound in the archaic art of every civilization. *Gloria* was the word associated with these decorated portals, and it was the Glory of the Court of Heaven. The skeleton plan for their arrangements was laid out in the cloister and passed on by means of manuscript illumination to the stonecutter. But nothing was lost in the transmission of the idea; for, sharing to some degree the fervor of his monastic brother, the artist thought in monumental and reverential terms, carrying out his program without injecting into it his own personality. This anonymity may account for the ability of the medieval craftsman to rise above the limits of an established iconography and to communicate in terms of universal human experience.

From the fall of Rome to the fall of Constantinople a thousand years later the principal actors gradually and quietly receded from the stage, giving first place to the great chorus of the heavenly host. The fathers of the early Church acknowledged with one voice the inadequacy of man and the desire for mortification of the flesh so eloquently expressed in the *Confessions* of St. Augustine. The great personalities of the Dark Ages, except for a few happy local magistrates for whom consecration and canonization was the order of the day, were for the most part beyond the pale. The barbarian chieftains were busily sacking Rome and nibbling at the borders of her empire. Not until the time of Charlemagne, who was crowned Holy Roman Emperor at St. Peter's in the year 800, do we find the vigorous assertion of a reigning personality colorful enough to be immortalized in epic poetry. Glory for the individual, if there was to be any glory at all, was confined to fragmentary and vicarious participation in the glory of God and in the sacramental life of His Son Jesus and in the womanly grace of the Virgin Mary. The artist and the writer had ceased to be independent in the sense of creative individuals of our own day. They were servants or instruments for the propagation of a faith and a point of view which was universally accepted.

Of the tens of thousands of works of art executed in the Middle

Ages – painting, sculpture, and the so-called minor arts – only a fraction are signed by the artists who made them, and where signatures do appear, they are not so much for the purpose of immortalizing the creator as a means of identifying an historic event or donation to a religious establishment. The medieval artist had returned to the truly archaic attitude; his work of art, into which he had poured so much of his own emotional existence, was an expression of the religious beliefs which he shared as a member of the Christian community and not merely the reflection of his ego.

Medieval or archaic art is not a uniquely Western phenomenon. The most notable parallels occur in the Gupta sculpture of India and in the Pre-Columbian monuments of Mexico and Peru. The monastic art of China likewise shows many similarities with that produced in the Christian communities of Europe. The emotional distance between Yunkang and Avallon is not so wide as it first appears, and it has even been suggested that there is an analogy between the mystery of the virgin birth and the parable of the lotus flower pushing its way up through the mire. The asceticism of the Buddhist monk sprang from the same emotional and religious impulses that created the Cluniac reform, and it is inevitable that they should be expressed by that impalpable quality which characterizes every variation of the archaic.

To enumerate the other places and periods where this circumstance occurs would be to prepare a catalogue for some ethnographic museum. In all of the primitive cultures of the Americas and of the Oceanic world we find similar developments. African Negro sculpture, so popular because of its abstractions, offers a splendid field for study, since it is possibly the most recently executed primitive art that we know. Abstract it may be and perfect in its conception and design, but none the less it remains essentially anthropomorphic. The Negro sculptor feels his living God as God, and the smile which we see upon the face of the statue is a translation into stone or wood of his reconciliation with the infinite.

The archaic concept is, however, too often overlooked simply because archaic art has always appeared to be a product of the past. Yet the fact that its simple qualities are so appealing to the individualists of the twentieth century is worthy of consideration. It suggests perhaps that in the present day we are starved for universals – for ideas and ideals that transcend our all too finite lives and habits of thought. In contemporary art the emphasis is nearly always placed

upon the particular rather than the general; the great community of belief in which all men shared and shared alike has fallen prey to the privy experience and the momentary incident.

The problem today, then, is not so much that of a lack of a single conviction but the multiplicity of convictions with which the creative artist is confronted. For two thousand years western civilization has been concerned primarily with a monotheism in which the various levels of the hierarchy have been not only established but accepted by people in all walks of life. The iconography of the Judeo-Christian world has thus been for many centuries clear to both the artist and the spectator; and it has been taken by each of them as a matter of course. So, too, was it with the classical heritage of the Greco-Roman pantheism. Bacchus was as identifiable as St. John, and Moses could be distinguished from Hercules by the most lowly member of society.

All of this is changed today. In the rapidly expanding, secularized world in which we live, where neither the Bible nor Bulfinch's *Age of Fable* seems to play any useful role and where one person's gods appear to be as good as the next person's, it becomes imperative that there be a return, if not to the gods of our fathers themselves, to some unifying principle in which the twentieth century man of many faiths can find the comfort of authority. For the artist has ever required authority as a framework – a point of departure – for his own experience. The most telling lesson of the history of art, indeed, is that there is nothing new under the sun; a new movement at most is a return to a simpler expression of an already accepted fact.

* * * * *

Throughout the past twenty-five hundred years the portraitist and the biographer have been inseparable companions. They have pursued the path of realism, sensible to the same vicissitudes of political and social circumstances and responsible to similar conditions of environment. Appraisal of individual character and personality has been their joint compulsion and preoccupation. To the degree to which they have re-created human beings, recognizable creatures of flesh and blood, they have added stature to their respective arts and established a rapport between their artist's world and the larger world of those whom they have chosen to depict. Theirs is an ancient and honorable association, so ancient and so honorable that it is perhaps well to inquire into the historical and

philosophical premises upon which it was founded in order to understand why portraiture and biography, more than most other forms of art and literature, have succumbed to the fragmentation of twentieth century living.

These two arts, primarily concerned with the representation of people rather than with the illusions of place or circumstance, were slow to arrive upon the stage. There had, in the beginning, been little need of them; for in the more primitive societies personality played a negligible role and it was sufficient to depict whole categories, such as warriors, huntsmen, servants, gods, and goddesses without identifying them more specifically as Warrior Smith or Huntsman Jones. But by the time of Alexander the Great the world was ready to narrow its focus in the examination of individual appearance and mannerism. It is therefore not altogether an accident of history that the most splendid Hellenistic portraits should have appeared more or less simultaneously with the publication of the *Characters* of Theophrastus and the histories of Alexander by Aristobulus and Ptolemy Soter.

The new attitude toward the sitter arose out of the Greek's admiration for famous men and began to blossom in the last quarter of the fourth century before Christ. The simplicity and anonymity of archaic art, which had flourished three hundred years earlier, had, it seems, given place to the restrained realism and classic calm of the Parthenonic style. By the end of the fourth century the Greeks had become familiar with almost every form of art. They had progressed by successive steps from the archaic to the pure and formal – though more narrative – stages of the Age of Pericles to the restless agony and illusionism of Alexandria and Pergamon. *The Dying Gaul* and the *Laocoön* are the epitome of this development.

According to long-established custom it had been obligatory for the portrait to be a true likeness of the sitter; this was the state of affairs that existed when Aristotle was developing his famous doctrine of imitation. Rightly or wrongly, Aristotle has always been considered the champion of the theory that art is the imitation of nature. But even for him simple imitation was not enough. He took the position that poetry – which was, he thought, imitative art in its highest form – is an expression of the universal element in human life, revealing in its "form" the essential features of the original and eliminating all that is transitory and ephemeral. Beneath the indi-

vidual it discovers the universal and passes beyond the bare reality given it by nature to express a more purified reality, "disengaged from accident, and freed from conditions which thwart its development." Thus the real and the ideal become virtually the same but are freed from contradictions and chance disturbances.

Aristotle remained for many centuries the rock upon which aesthetic theory was established. Even today his position furnishes the most cogent argument for the man in the street who wants the work of art to resemble something with which he has long been familiar. But critics of the nineteenth century, fortified by the discovery of photography and all that it implied, unfortunately distorted Aristotle's maxim by resolutely and narrowly maintaining that "art at all cost *must* imitate nature."[2] They made no allowance for individual expression or interpretation.

Aristotle shared something of Plato's contempt for the painter and the sculptor. But the latter, opposing Aristotle's views on imitation, dismissed the artist as "fraudulent, illusionistic and far removed from truth." Plato found beauty in "straight lines and circles, and shapes plane or solid, made from them by lathe, ruler and square." Strange as it may seem, the retreat from likeness which has reached such extravagant proportions in our own day was argued more than two thousand years ago in the dispute over representation and abstraction between the two most celebrated philosophers of ancient Greece.

Both of them, however, placed the emphasis on the artistic product rather than upon the act of artistic creation. For, although Aristotle was willing to allow the pleasures of philosophy for those who philosophize, as an intellectual end in themselves, he insisted that the pleasures of art are not for the artist but for those who enjoy what he creates. If the artist is to share at all in the pleasures of the finished work of art, he does so not as its creator but as its spectator.

It is but a short step from the philosophy of Plato and Aristotle to the concept of Greek portraiture, for in this art the Greek was able to convey not only the generality of the Greek ideal of "philosopher" or "emperor," but likewise his curiosity and interest in identifying for all time the specific individual. He was able to express not merely the man and his character, but also his experience

[2]See S. H. Butcher, *Aristotle's Theory of Poetry and Fine Art* (London. 1895).

and achievements. The world of reality and the world of imagination became fused, and the breath of poetry kindled the facts of experience and the traditions of the past. It must be remembered that the *Ideal* in Greek art was not the opposite of the *Real*, as we think of it today, but rather its fulfillment and perfection. "Each sprang out of the same soil; the one was the full blown flower of which the other was the germ."[3]

If the Greek portrait resembles the fully rounded prose biography, Roman portraiture, because of the Roman's sense of actuality, has something of the character of an obituary notice. In the portraits of the Roman emperors from Augustus to Trajan and the Flavians, the perpetual conflict between Greek idealism and Roman timeliness continues. To be sure, most of the portrait artists in Rome had been imported from Greece; nevertheless one can always detect in their work the struggle between the imagination of the sculptor and the factual record of the death mask. Only later, when the capital had been transferred to the shores of the Bosporus, do we see a new style once more emerge, in which the two rival strains are fused and are forgotten.

The retreat from likeness was already in full cry at the moment of Constantine's conversion to Christianity A.D. 312. In 330 the city of Constantinople was founded on the site of ancient Byzantium, and by the end of the century the Emperor Theodosius had separated the empires of the East and the West. The Hellenic tradition, which had dominated Rome during the republic and the Augustan Age, fell victim to Asiatic subjectivism. Latin Christianity as a vehicle for art was, in fact, almost on the point of extinction during the barbarian invasions, although it continued to give lip service to the Greek ideal of rational man – what today we would call the extrovert – untrammelled by the joys or vicissitudes of everyday life. The Eastern Church went its own independent and separate way, following the path of the Byzantines, who sought to revive the glories of Athenian art of the fifth and fourth centuries B.C., wherein the human figure was removed and isolated from its background of illusionary space and rendered two-dimensionally, like a paper doll against the backdrop curtain of a child's theater. To these technical difficulties were added the sense of sin and the universal desire for salvation which had swept the Mediterranean world.

[3]S. H. Butcher, *op. cit.*

These were, to be sure, newly recognized as conditions of the human soul, which were compatible with the doctrines of Plotinus, a great neo-Platonist of the third century A.D., who was to exercise an overwhelming influence on the future development of Christian thought and doctrine. In a celebrated passage of the *Enneads*, Plotinus opened the door to the present-day metaphysical concept of the artist, who, once and for all, cast aside his traditional role of artisan and, in the words of St. Paul, put upon himself "the armor of light." He has been wearing this invincible and sometimes invisible garment ever since, like Hans Christian Andersen's "emperor's clothes." Already in late antiquity the artist had become different from other men; he was the High Priest who, having been granted the vision of divinity, conferred its form upon his material.[4] Plotinus wrote:

> Withdraw into yourself and look, and if you do not find yourself beautiful yet, act as does the creator of a statue that is to be made beautiful: he cuts away here, he smoothes there, he makes this line lighter, this other purer, until a lovely face has grown upon his work. So do you also: cut away all that is excessive, straighten all that is crooked, bring light to all that is overcast, labour to make all one glow of beauty and never cease chiselling your statue, until there shall shine out on you from it the god-like splendour of virtue, until you shall see the perfect goodness surely established in the stainless shrine.

Since the time of Plotinus, the history of art has gradually become more concerned with the flight from reality and with the emotional life of the artist than it has with the physical reality of likeness of the work of art itself. For the better part of a thousand years the Church placed the emphasis on *evocation*, giving second place to the recognition of the object represented. The retreat from likeness had completely captivated the imagination of the artist. Not until emphasis was placed on the rediscovery of man in the early years of the Renaissance did objective reality again command his attention.[5]

[4] S. H. Butcher, *op. cit.* Plotinian dogma, however, was challenged in the nineteenth century by Schopenhauer, who held that divine perception is vouchsafed only to the gifted genius and not to ordinary mortals, for whom the one hope lies in escape from the world of external appearances. Between these two conflicting viewpoints the doctrinal controversies of modern art continue to rage.

[5] See Frances Bradshaw Blanshard, *Retreat from Likeness in the Theory of Painting* (New York: Columbia University Press, 1949).

More recently the history of the decline of portraiture has begun to claim the thoughtful consideration of many critics, who are frankly puzzled by the equivocal position of the likeness in contemporary art. The question arises as to whether or not it has indeed any validity for future generations. There are those who believe that the camera has forever destroyed its purpose and its market. But these are a limited and fanatical elite who also hold that the figure arts in their entirety are doomed to destruction. And they have so little knowledge of the past that they are unaware that these burning issues of today have smoldered for many centuries, only to burst into flame and become again partially extinguished whenever new crises occasioned by war and social upheaval perplex mankind.

Such critics, also, fail to realize that there has always been a frontier art which is a corollary to the traditional, classical, and humanistic acceptance of man as the measure of all things. Berenson defines it as a marginal or peripheral art, owing its characteristics chiefly to lack on the part of its artificers of proper training, training in the most essential requirements of the arts – namely the representation of the human figure. He poses the question of whether or not the artists of late antiquity in their incompetence and inability to produce a likeness were the victims of the general collapse which had overtaken the city and the Empire, or whether, as the Viennese school of Riegl and Wickhoff had maintained, it was an unconscious *Kunstwollen* by means of which they sought to become the precursors of modern art. Berenson continues:[6]

> Self-satisfied incompetence on the part of the artist, complacent indifference if not enthusiastic approval on the part of the public, characterizes an ebbing civilization, leaving little but wreckage and refuse interspersed among the proud ruins of once noble cities. The surviving denizens salute every destruction, every distortion, every successful attempt to lower what is left of past splendour to their own level of debased and crippled intelligence. . . .
>
> . . . as a civilization shrinks, the peripheral or marginal region gains upon the interior until it finally conquers the centres, reducing Babylon and Memphis, and Thebes of the hundred gates, to deserts, Athens and Antioch to small market towns, and Alexandria to little more than a fishing village.

[6]Bernard Berenson, *Aesthetics and History* (Garden City, N. Y.: Doubleday & Company, Inc., Anchor Books, 1954).

The art that once was barely good enough for the precarious frontier is now all that the former capitals can achieve. . . .

[This] peripheralism or marginalism (if we may use these terms) is due to the abandonment of the artisan to his own devices, freed from the inspiration and control of the artist. It can occur at any time and in any place, as indeed we see today in London and Paris and New York.

* * * * *

A change in the philosophical attitude toward the problem of individuality likewise became evident in the letters of the late antique period. Compare, for example, Xenophon's *Memoirs of Socrates* with the *Lives of the Twelve Caesars* by Suetonius. Neither consisted of true biography as we conceive the term today. Rather they were lessons or tracts in which history was taught by precept; the people depicted were examples or archetypes rather than living personalities, although in the Greek there was a deeper obligation to present the overall concept of the individual and to place him properly in his world. This was a continuation of the Hellenic interest in the general rather than in the particular, and we find it as late as the first century A.D. in the biographical writings of Plutarch, Philostratus, and Diogenes Laërtius. The Roman, on the other hand, could not refrain from looking at life through the keyhole and of setting down the gossip of the fleeting moment at the expense of the larger interpretation of his subject's character and personality. This was a tendency which was to last throughout the decline of Latin culture.

It is inevitable that the rediscovery of man by man in the Renaissance should take him once again along the high road of portraiture and biography. For it was in this period that he reached his highest development as an individual and applied himself to the study of his true nature in all forms and under all conditions.

Throughout the fourteenth and fifteenth centuries in Italy, man was gradually awakened to the fascination of his character and personality. It was a process which had started deep in the Middle Ages and continued almost imperceptibly through the voices of the poets and philosophers. Charles Homer Haskins has demonstrated the unbroken aspect of European culture in his *Renaissance of the Twelfth Century*, and more recently Jean Seznec at Oxford and C. S. Lewis of Cambridge have reiterated the theme which no longer accepts the now old-fashioned and traditional view that man appeared to break away from the bondage of the scholasticism of the Church

and looked into the mirror of his own potentiality. Wherever these fashions in historiography may lead us, the reading of the works of art that have come down to us is perhaps less penetrating and more factual. The greatest historians, Lewis[7] tells us in his brilliant inaugural address, are, like himself, "less like a botanist in a forest than a woman arranging a few cut flowers for the drawing room. . . . We can't get into the real forest of the past; that is part of what the word *past* means."

Already with Dante and Petrarch the search for truth had turned to the study of the individual. Here for the first time he was revealed both in his greatnesses and in his weaknesses. The Italian historians, according to Burckhardt, were the earliest among those of the European nations to display any ability or inclination to describe man accurately as he was placed in depth and in the perspective of history, and according to his inward and outward characteristics.

The early biographical writings of the Renaissance witnessed a deeper penetration into character and circumstance. Then gradually the fashion for the lives of men and women yielded to the more candid and intimate pleasures of autobiography, culminating, for example, in that of Benvenuto Cellini. Burckhardt[8] wrote:

> It does not spoil the impression when the reader often detects him [Cellini] bragging or lying; the stamp of a mighty, energetic, and thoroughly developed nature remains. By his side our modern autobiographers, though their tendency and moral character may stand much higher, appear incomplete beings. He is a man who can do all and dares do all, who carries his measure in himself. Whether we like him or not he lives, such as he was, as a significant type of the modern spirit.

Italian humanism, which had so devoted itself to the study of the classical past, imitated its modes of thought in order to recapture and develop a scientific attitude of observation and experiment; it sought to perfect its literary style and its appreciation of beauty. The acquisition of culture became a means of enriching the mind and life of the individual who, for the first time since classical antiquity, came to regard the secular world as his spiritual home. It was no longer a place of exile in anticipation for the life to come;

[7] C. S. Lewis, *De descriptione temporum* (London: Cambridge University Press, 1954).

[8] Jakob Burckhardt, *Civilization of the Renaissance in Italy* (London: Phaidon Press, Ltd., 1950), p. 203.

social or religious regeneration was a matter of little concern. The humanist of Italy was obsessed neither with ethics nor with religion but rather with the emancipation of his intellect.

Under such novel conditions it is not surprising that a new latitude was allowed in the choice of subject matter. The Church, which continued to be the most lavish and consistent patron of the Renaissance artist, encouraged experiment and advocated, particularly where no tenet of the Christian faith was jeopardized, the recollection of pagan myth and classical allusion. And although the more rigid formulas of medieval iconography were incorporated in the contracts between the artist and the patron for any work destined to embellish ecclesiastical property, a wide interpretation of basic themes was tolerated. Very often an unholy alliance of saints and martyrs with the gods and goddesses of Mount Olympus served as a bridge between the old world and the new, as in the deliciously imaginative Tempio Malatestiano at Rimini. Such secular departure from religious and dogmatic subject matter later culminated in the reforms of Savonarola, who was himself consumed in the flames which he had lighted in the Florentine piazza in order to wipe out the evidences of fashionable idolatry.

Thus were provoked questions regarding the rights of the artist and those of the patron commissioning a work of art which are not yet resolved. Prior to the Renaissance they had not indeed arisen, for the subject was invariably prescribed by the clergy and it did not occur to the artist to deviate in any way from the rules laid down for him to follow. It was only in so far as his own talents or genius permitted him to do so that he could rise above the conditions imposed upon him and breathe into his creation the very life-enhancing qualities that eternally distinguish the masterpiece from the routine production of the workshop.

Prior to this moment in history both artist and patron believed passionately in the subject matter of the work of art. The medieval sculptor emphasized the nobility of Christ and the dignity of His Church, the classical artist the beauty of the human body, and the Chinese the more devotional aspects of Buddhism. But with the advent of individualism in modern times a note of cynicism appears to have crept in. Authority in art was no longer derived from the grace of God but was accepted as a state of human grace arrived at by the mutual consent of a willing buyer and a willing seller. This was especially true of portraiture, where the will and vanity

of the sitter was in constant danger of conflict with that of the artist.

This peculiar gift of penetrating into the character of the sitter and recording his personality – something which the mechanism of the camera can never accomplish – had long occupied the attention of the artist. In the memorable words of Charles Dibdin, the eighteenth century biographer, "We form the minds of men not from their qualities but from our judgments. We seldom look into their motives such as they are, but as we wish them to be. . . ." Both the portraitist and the biographer soon found themselves unwittingly cast in the dual role of advocate and judge, and the seeds of suspicion between the sitter and the limner were sown.

From the age of the despots through the absolute monarchies of the seventeenth and eighteenth centuries, a balance between the conflicting temperaments of painter and patron was momentarily guaranteed by the intervention of the Painters' Guild, whose word was final in the event of a dispute between the two. So long as the Guild was there to protect the artist the art of portraiture flourished. The artist was able to look upon the commission as an expression of his personal vision of the sitter. He did not feel obliged, as he so often does today, to bolster his own insecurity by glorifying the millionaire who employed him or to show his contempt by patronizing him.

Portraiture and biography had clearly followed the same road as that pursued by the individual. For no sooner had man rediscovered himself in the sixteenth century than he laid himself open to the fragmentation of the modern world. His hedonistic freedom was short lived; it did not, in fact, survive the Reformation – which circumscribed him with a new set of prohibitions and proscriptions – and the rise of nationalism which heretofore had barely entered into his consciousness.

Successive waves of internationalism, which had so long dominated the European scene, had likewise broken upon the shores of local and civic pride, and the rise of the middle class had placed a new premium on the efforts of the burgher and the merchant. They were no longer willing to accept the absentee ownership of a feudal aristocrat, who resided in many instances hundreds of miles away and who cared relatively little for the welfare of his hereditary subjects. Attachment to the soil was replaced in the cities by attachment to local customs and to those peculiar circumstances which made one

locality different from another. Nationalism was indeed the expression of the free man, the oligarch, who had made his own successful way in the world.

The portrait – both of the pen and of the brush – began soon to reflect simultaneously his newly acquired characteristics. The eighteenth century portrait in England, whether it was painted by Gainsborough or written by Boswell, suddenly became excessively and unmistakably English, just as French painting and French prose lost the international flavor which they had enjoyed in the Renaissance and not merely became Gallic in their essence but bore the stamp of that aristocratic superiority and arrogance which did not end until the Revolution. The sitter was placed squarely in his milieu; he had become part of a national system and of a national caste from which he was powerless to free himself.

Thus when the nineteenth century ushered in different modes and attitudes in the delineation of the individual, the artist was faced with the necessity of choosing between the effigy and the portrait. Berenson has pointed out the distinction between these two forms of likeness in easy and quite simple terms. The portrait, he claims:[9]

> is the rendering of an individual in terms of decoration, and of the individuality of the inner man as well as of his social standing. That is what Rembrandt, for instance, did supremely well, particularly in his last years. The effigy, on the other hand, aims at the social aspects of the subject, emphasizes the soldierliness of the soldier, the judiciousness of the judge, the clericality of the clergy, the self-importance of the business or professional man, the fashionableness of the woman of fashion, the clubableness of the clubman.

So long as society remained stable the role of the portrait painter and the biographer was relatively easy provided the artist mastered a few simple rules of technique. First he was obligated to produce an effigy – a good, objective physical likeness of the sitter. Then, as the Victorian interest in that ineffable thing called "character" grew more pronounced, the task became more complex and was susceptible of being approached not from a single viewpoint but from a great many conflicting angles. In the words of Sir Harold Nicolson, biography had become "the occupation and solace not of certainty but of doubt." Like the portrait, it was the symbol of insecurity and marked the surrender of man to the tragic elements

[9] Berenson, *op. cit.*

within him. Subjectivism reached its highest point in Proust, who "reduces the whole idea of personality to dust. . . . There is nothing left by which to recognize man save his name, his body, his clothes, and a few external mannerisms." Like those colonies of marine animals living at the bottom of the sea, man is reduced to being "a colony of feelings, a coral-reef of diverse personalities."[10]

The break with tradition occurred in the dozen years between the death of Queen Victoria and the outbreak of the First World War. Man had ceased to be a valet to his hero, whose feet of clay were already soiled and crumbling with a hundred years of industrial revolution. No longer was the noble or the oligarch sustained by protocol or the prestige of wealth. Even the sumptuary laws governing the character of his dress and external appearance had been abandoned; gold braid and diamond tiaras were available to anyone who could afford to rent them from the costumer for the evening. The man at court was scarcely distinguishable from the man in the street.

The denigration of the individual was as apparent in painting and sculpture as it was in literature. Regardless of the medium in which he worked, the artist became painfully aware of his own inadequacy. Augustan and Victorian biographies in the manner of Plutarch were superseded by the new psychological analyses of the subject so popular today. The reason for the change, André Maurois further explains, is that the reader "longs to believe that others have known the struggles which he endures, the long and painful meditation in which he himself had indulged. So he is grateful to those more human biographies for showing him that even the hero is a divided being." The artist's refuge was to withdraw into himself, and the distinct and indivisible concept of personality as a unit was lost.

The awareness of the contemporary artist of this remoteness from the daily life of tradition has become something of an obsession with him. Conscious of his loneliness and his inability to communicate with ordinary mortals, he has developed a defensive mechanism and rationale which express themselves in many different ways. During the Spring months of 1956 a group of a hundred or more prominent artists in Paris under the aegis of *Les peintres témoins de leur temps* presented an exhibition at the Musée Galliera entitled

[10] André Maurois, *Aspects of Biography* (New York: D. Appleton and Company, 1929).

Réhabilitation du portrait. It was a brilliant if disconcerting show, for all of the giants of the postwar world were there in person, delineated by some equally fashionable and quixotic painter or sculptor. But it was the catalogue which as a record of the contemporary scene outshone the pictures. Each of the portraits in the book was accompanied by a photograph of the artist and the sitter posed together in the studio while the likeness was being taken. And each portrait was clarified by a page of prose or verse offering a psychological interpretation of the abstractions which had been substituted for reality and the justifications in each instance for departing from the photograph. It was as rarefied a piece of intellectuality as Paris had seen since the days of Marcel Proust. In the preface to the catalogue the poet and director of the Musée National d'Art Moderne, Jean Cassou, wrote:

> Our epoch is conscious of the existing disaffection for the art of portraiture which undoubtedly arises from the success of photography. It also stems from the fact that for more than a century painting has thrown itself into high and magnificent speculation and has moved away from its exclusive and primordial concern with the representation of reality, that is to say, what is commonly understood by the representation of reality. A third, even more profound, reason may be found in the divorce which, since the middle of the nineteenth century, has separated living art from society so that all we possess of Manet, of Courbet or of their successors are the portraits of their few intimates and familiars, who were too often outcasts like themselves – Proudhon, Baudelaire, the writers and amateurs who defended them, Zola, Duret, Doctor Gachet, Coquiot, Apollinaire, Gertrude Stein, and frequently figures from the Bohemian world and from the circus and music hall. Generally speaking, the painters of the past century have left us the effigies of individual personalities, but not, as in more ancient epochs, a gallery of the society of their time.

In virtually every statement by the artists in this fascinating book – or by inference in the commentaries by the portrait subjects – there is a pervasive nostalgia for a day when the conflict between the painter and the painted was less acute, when the objectivity of personality and class distinction permitted a more detached and less emotional interpretation of the sitter's appearance and inner character.

The explanation for this impasse, this almost mental block, which has reduced the portraitist to the acceptance of one or the other of two roles, that of camera man or that of abstractionist, has been

suggested by an American critic Frederick S. Wight, who is himself a painter, novelist, and biographer of contemporary artists:

> Looking back, Freud, Joyce and Picasso to name only the great with the mark of the age upon them – all appear to have had a common endeavor, the taking apart of the personality in all its complexity. The personality now becomes multiple, a plural noun like army, orchestra or cast. We have stepped through the eye into a universe vast as the one outside. All is now portrait, so expanded that it has become unrecognizable – the portrait of the age. By contrast, glance back at the nineteenth century – an age of faces, heads, biographies, packed companionably together like books on a shelf. But modern man is more and less. Because he is everything, he has grown invisible. Instead of individuals it is concepts, themes, doctrines, which stand out. They are superstructures based on impulses, on shared fragments of personality. It is of course this fragmentation which has been both the result and the means of exploration which delights the modern mind, invites restlessness, and for the painter often robs his canvases of finality.

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There are essential differences between a sculpture of the Age of Pericles and a more modern work. The classical approach is instinctively and fundamentally intellectual. The Greek artist, like the scientist and philosopher, placed the emphasis on clarity and ignored what was outside of human experience. A relief from the Parthenon frieze, for example, expressed a generality of concept, never a specific experience. The background of the relief is neutral and indefinite; the scene or event portrayed is not restricted to the limitations of time and space; environment is seldom if ever indicated before the time of Scopas and Praxiteles, in the fourth century, and then only in the general sense. The human figure at first is subject to the severest discipline of symmetry, of formal composition; portraiture, until the Asiatic influences brought in by Alexander's conquests, was virtually unknown. Then and only then did subjectivism creep in; the Pergamene and Alexandrian schools introduced into Western Art the sense of pain and immediate sensation caused by specific circumstance that we see in Alexandrian sculpture. But by that time the classical world was breaking up. Mithraism and Christianity brought with them the concept which was to engulf the medieval world – the idea of sin and its forgiveness through the practice of faith. The Greek ideal of clarity was to yield to an equally compelling ideal of mystical reality.

The Gothic Madonna, in contrast to the earlier Attic votive statues, reveals the differences of philosophical approach between the two civilizations. Whereas the classical statue expresses an idealism which renders truth – empirical and amoral truth – into a memory picture of an idea, freed from the limitations of setting, abstract and intellectual, the Madonna conversely uses the same technical means in making a statement of quite another kind. The representation is of Mary and Jesus; this immediately puts the statue in a tight compartment of time and space. Automatically both artist and spectator are called upon to contemplate a relation between two individuals who at the same time are both human and divine – the Blessed Virgin and the Son of God. Even the event is brought within a given limit of time and space – Bethlehem during the infant years of the first Christian century.

Herein lies the difference between Greek idealism and the intuitive realism which appeals so much more to the Teutonic and Anglo-Saxon temperament. It is the complete negation of the academic point of view, which was, of course, a perversion of the classical ideal; the Madonna is the attempt to render, not truth through a generality, but truth as it is vested in the particular, conditioned by circumstance. But more important than any of these elements is the sense of the infinite which pervades the whole of Gothic art and lies at the bottom of the new medieval style in architecture.

The Gothic cathedral is the epitome of the interest in the new realism. Human interest, pathos, and individual memories replace the familiar generalities and concepts of the Greco-Roman world. Sculpture abandons its static calm, is frankly episodic, and becomes more animated and less remote from life. Color is employed to enhance the mystical effect and is intimately interwoven with the symbolism of religion. But it is above all in the philosophy of space in architecture that one observes the greatest change. Whereas the Greek sought to avoid the indefinite, and composed with clearly established forms, the medieval architect, wishing to express the mysteries of the infinite, composed with segments of enclosed space, untenanted and majestic. "Solution of form in space," Charles R. Morey[11] has insisted, "is the Gothic builder's purpose, to unite the material with the divine after the manner of the Christian mystic. Isolation of form from space was what the Greek was after, instinc-

[11] C. R. Morey, *Christian Art* (New York: Longmans Green and Company, 1935).

tively excluding from his concepts that which could not be defined.

If the Gothic cathedral symbolized the variety and individuality of Christian existence, it did so none the less according to a strict discipline and formula. In its very construction, where each detail played its specific purpose in expressing the glory of God, it became the synthesis of Christian dogma and belief. It was the concrete embodiment of the theology of St. Thomas Aquinas – but it also was a synthesis predicated on the leadership of the Church. This in turn was doomed to break down in the later Middle Ages before the emergence of Renaissance man. Here at last was an individual who breathed the air of freedom, who could draw upon any source, pagan or Christian, for his subject matter, and who could give unlimited expression to fantasy and invention. The Christian unity of the Middle Ages was broken, and the artist was to enjoy a momentary liberty before bowing once again to the academic classical ideal.

But the political misfortunes which darkened Europe in the sixteenth century were soon to put an end to the playful independence of Renaissance man. To be sure, he had come into his own, his stature was everywhere reflected in the monuments he had created – ostensibly for the glory of God but essentially to magnify his own importance. The climax was reached in the golden age of the papacy, when the temporal magnificence of God's vicar all but snuffed out the sacred flame which had been handed down from early Christianity. Italy was invaded by Charles V, the city republics of the Middle Ages were reduced to bondage, and the religious community was torn asunder by the conflict between Protestant reform and Catholic reaction.

From these calamities emerged a graver, more sober attitude toward art. In their anxiety men turned once again to the experience of classical antiquity, but in their return to the past they lost themselves within it. Beauty was divorced from truth, and art became theory instead of practice. The academic point of view of the seventeenth century was not so much the triumph of mind over matter as it was the complete triumph of tradition over human will.

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John Donne, preaching before King Charles I at St. Paul's on Christmas Day, 1625, asked the question:

What eye can fixe itself upon East and West at once? And he must

see more than East and West that sees God, for God spreads infinitely beyond both: God alone is all; not only all that is but all that is not, all that might be if he would have it be. God is too large, too immense, and then man is too narrow, too little to be considered; for who can fixe his eye upon an Atome; and he must see a lesse thing than an Atome, that sees man for man is nothing.

Pascal echoed the same refrain: "What is man in nature? A nothing in infinity, an everything in regard to nothing, a middle point between everything and nothing."

It did not require a stockpile of uranium 235 to convince the poet, the philosopher, and the prelate of the seventeenth century that, although the atom had not yet been split, fission had already taken place in man. The separation of the soul from the intellect could lead, they held, only to inevitable disaster. The atomic age had begun not with Hiroshima or Nagasaki but with Democritus and the earliest physicists of Greece. The medieval synthesis had been explored, voyages of exploration on land and sea had produced new worlds to conquer. The Reformation as well as the Counter-Reformation of the Jesuits had concerned itself with the problem of the individual and his conscience – that spark of God within him – and its relation to the constantly expanding, yet at the same time increasingly particularized, scientific universe.

While Colbert and Lebrun, building upon the intellectual ground plan of Richelieu, had been erecting the structure of the academies of art, the spirit of authoritarianism had begun to infect mathematics and astronomy, the natural philosophies, and the realm of metaphysics. There was a constant pressure to reduce all natural phenomena to natural law. What law you accepted depended entirely upon which side of the angels you wished to stand – to the right with Descartes, who reconciled the order and rhythm of the universe with the ideal of a supreme being capable of revealing himself according to the beliefs of the Catholic Church, or, at the other extreme, with the mechanists, who refused to concede the existence of any reality which was not predetermined by reason or the senses. In both camps the chief concern was always with infinity.

The artist of the baroque and rococo, on the other hand, protected by a hard enamel of convention, seldom penetrated the inner recesses of science or philosophy. Only in the *trompe-l'œil* decoration for a ceiling, where cloud-enveloped *putti*, foreshortened and provocative, are casting slings and arrows at outrageous fortune, do we see him

struggling with the doctrinal disputes of the day. Yet in the atelier as in the observatory it was the fashion to pursue the answer to ultimate causes in the heavens. Whereas in science the contribution of the individual was subordinated to the progress of a group of like-minded seekers after truth who moved inexorably toward the common goal, the artist was more subjective and responded to the inner compulsions of his own creative genius.

Reality, then, whether it was the subjective mystical reality of El Greco or the objective realism of Vermeer, was the preoccupation of the artists. But it was the intensity of the human element in a picture which alone could make it rise above the literal and factual representation of the little masters. In Rembrandt, possibly, is the full realization of that belief accepted by scientists today that "reality must have something of a mental nature."

Metaphysical anxiety and restlessness, so characteristic of the seventeenth century and its art, was followed by the frankly skeptical inconsequence of the eighteenth. Elegance and form were more important than the content. The modern age had yet to await the full expression of its absolute materialism in the doctrine of determinism.

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The art world today is divided into two camps, those who wish to preserve the ageless and guiding principles of humanism and those who seek to find in art an expression of their own groping with the mechanical determinism of the present day. Each side is making extravagant claims that it alone is the defender of the true faith; yet they make no effort to define either their terms of reference or the historical meanings of the terms themselves. The humanities today are understood by the masses as that residue of human experience which has proved to be of no practical value whatever in the ordinary conduct of contemporary life, whereas the sciences, bereft of philosophical or speculative significance, appear to offer the answer to every maiden's prayer.

In the minds of both parties there can be no innocent bystander. The spectator, regardless of which orthodoxy of art he accepts, must be resolutely for or against sin. There is no middle ground between heaven and hell, and certainly no limbo or purgatory in which he may await the outcome of the religious warfare now being waged for the possession of his soul.

The gulf lying between the artist and his public is wide and deep;

it is the more serious because it has lasted now for nearly a century. Thus the thoughts provoked by this inquiry should not be considered as a polemic for or against contemporary art, but rather as an attempt to explore the terrain and climate in which the artist works today – for at best the painter and the sculptor are merely representative of their time and their environment.

The modern movement is not a theory; it is a condition. It is a condition arising out of a series of historical facts and consequences which center on the dignity of man – his position in the universe, his search for truth, and his constant desire to render truth in sensible form so that other men may grasp its meaning and its beauty.

Artists and laymen have become the victims of the scientific world they have created, and in their common fear for the future have lost contact with one another. The crisis in the arts is nothing more or less than the crisis of the human race. How far, one may ask, can the artist be held responsible for the society of which he is the product? How far can the *Zeitgeist* be laid at his doorstep? Are we to assume that he has sold his birthright for a mess of psychic and mechanistic pottage? No, nor can we lay the blame for unintelligibility alone upon the failure of the artist to continue the traditions of craftsmanship of the old masters.

Toynbee[12] has offered a partial explanation:

The prevailing tendency to abandon our artistic traditions is not the result of technical incompetence; it is the deliberate abandonment of a style which is losing its appeal to a rising generation because this generation is ceasing to cultivate its aesthetic sensibilities on the traditional Western lines. We have willfully cast out of our souls the great masters who have been the familiar spirits of our forefathers; and while we have been wrapped in self-complacent admiration of the spiritual vacuum that we have created, a tropical African spirit in music and dancing and statuary has made an unholy alliance with a pseudo-Byzantine spirit in painting and bas-reliefs, and has entered in to dwell in a house which it found swept and garnished. The decline is not technical in origin but spiritual. In repudiating our own Western tradition of art and thereby reducing our faculties to a state of inanition and sterility in which they seize upon the exotic and primitive art of Dahomey and Benin as though this were manna in the wilderness, we are confessing before all men that we have forfeited our spiritual birthright. Our abandonment of our traditional artistic technique is manifestly the consequence of some kind

[12] Arnold J. Toynbee, *A Study of History* (London: Oxford University Press, 1933, 1939), vol. IV, p. 52.

of spiritual breakdown in our Western Civilization; and the cause of this breakdown evidently cannot be found in a phenomenon which is one of the subsequent symptoms.

The artist has become the favorite whipping boy in this struggle between the intelligible and the unintelligible. Since he is supposed to be the custodian of that ineffable thing called beauty, he is blamed if he does not jealously conserve it without change, and equally blamed if he tries to place it within the context of the world in which he lives. He is condemned for being the cause, but never forgiven that he is merely the effect. If he has ceased to be a spiritual leader, it is only because he has no gospel to impart. The reserves of self-sufficiency are drying up; his day-to-day existence is controlled by a cruel and inexorable determinism which leaves little room for the exercise of his own free will and even less for the will of God.

Having accepted modern art as something which, while they never understood it, they nevertheless vaguely approved, the public, after three score years and ten of being told to like it, have begun to wonder whether they are not "being had." They are accustomed to daily accounts of world crises in the press and on the air. These are the stuff of which ordinary experiences are made, and in so far as the artist deals with them objectively the public is willing to admit his right to express his opinions and even to find, if he can, some beauty in them. But where the artist and the layman part company is in the realm of the subjective: interpretation, representation or nonrepresentation as the case may be, the psychology of color, and the myriad emotional and intellectual connotations with which every contemporary work is filled.

The issue for our generation is not so much one of principle as it is one of the degree of communicability versus incommunicability. And, while no sensible person would wish to turn back the clock, there are many who might wish to read its face without having to take its works apart.

The question is no longer one of technique or taste but revolves again about the venerable problem of reality. The "absolutes" which so disturbed the scholastics of the Middle Ages have been resurrected as fighting words. Obscured by the conquest of material existence in the nineteenth century, philosophy has again reappeared as the champion of those new freedoms of conscience and opinion which have resulted in the liberation of the individual. Having become his own center of activity, generating energy with a rapidity

such as the Western world has never known, man has misinterpreted his own researches into the modern world of science as the answer to ultimate cause and purpose. He has become, indeed, the arbiter of his own fate, but he has not yet learned that the cosmic is distinguished from the comic by only a single consonant.

The artist has been the victim of similar pressures and obsessions. During the past hundred years he has moved slowly from decorative arrangements of optical impressions to "the creative expression of the mind's dynamic perception." Reality of the mind has been substituted for the time-honored absolute of reality of the eye. The transition was made possible by the invention of photography, which demonstrated the difference between optical seeing, or observation of what is true to nature, and mental perception – that is, "the difference between reality as the eye sees it and the world of action as the mind perceives it."

We are confronted, therefore, with a conflict between two venerable truths inherited from the Renaissance, two types of reality: the one (dependent upon the concept of time and space) presents the picture of the world within the traditional limits of visual experience, and the other presents it from the point of view of personal emotion. Each of these truths is valid and to some extent circumscribed. Neither one attempts a teleological explanation of the universe. Man is the pivot about which the world revolves and he is absolved of any responsibility for its conduct.

There are, however, other important factors which have brought about the present revolution in the arts. A contemporary painter[13] has explained:

> What makes modern art different from the art of the past is that it is based on the combination of two nineteenth century discoveries – the one in the realm of technique and having to do with the unity of the paint surface of the picture, and the other in the realm of subject matter for painting. . . .

This technical discovery, Maurice Grosser declares:

> had already been made by the Impressionists. It is the doctrine of unified surface tension – that no matter what illusion of depth or space or reality a picture gives, a picture is after all an object and every square centimeter of that object must be equally interesting. . . . Before the

[13] Maurice Grosser, *Painting in Public* (New York: Alfred A. Knopf, Inc., 1948).

Impressionists, it was enough if the image – the various objects depicted on the canvas – was well composed. The Impressionists discovered that the surface of the picture must be composed as well, that the texture of the paint itself must be made interesting. The size, shape and direction of the brush strokes must not depend under any circumstances upon the size or modeling of the object depicted or on its position in the picture. They must depend only on considerations of unity of paint surface. One must be conscious of the picture as an object, as a flat surface covered with paint. . . . To achieve more completely this unity of surface, even the image may be sacrificed.

More recently another technical problem of the modern world has had its impact upon the artist – time is now conceived as a kind of fourth dimension projecting itself through space. Its impact has been a by-product of Einstein's theory of relativity and of the investigations in nuclear physics. Time and space are shown to be no longer absolute. But, even more, radar, television, and the rapid time-destroying projection of an airplane through space, in which we move from continent to continent as quickly as a telegram, have conditioned popular thinking. We are forced to bow before the "dynamism of change." Art, therefore, might conceivably become the illustration of energy rather than the illustration of form; the artist is thus presented with another reality or absolute as potential as electricity or atomic power.

Energy, then, whether it be physical or mathematical, biological or metaphysical, has suddenly presented a new reef of Norman's Woe upon which the *Hesperus* of accumulated aesthetic knowledge and experience inherited from antiquity, the Middle Ages, and the Renaissance has been wrecked. The survivors are struggling to a sandy and uncertain shore which is constantly receding with each new movement and artistic current.

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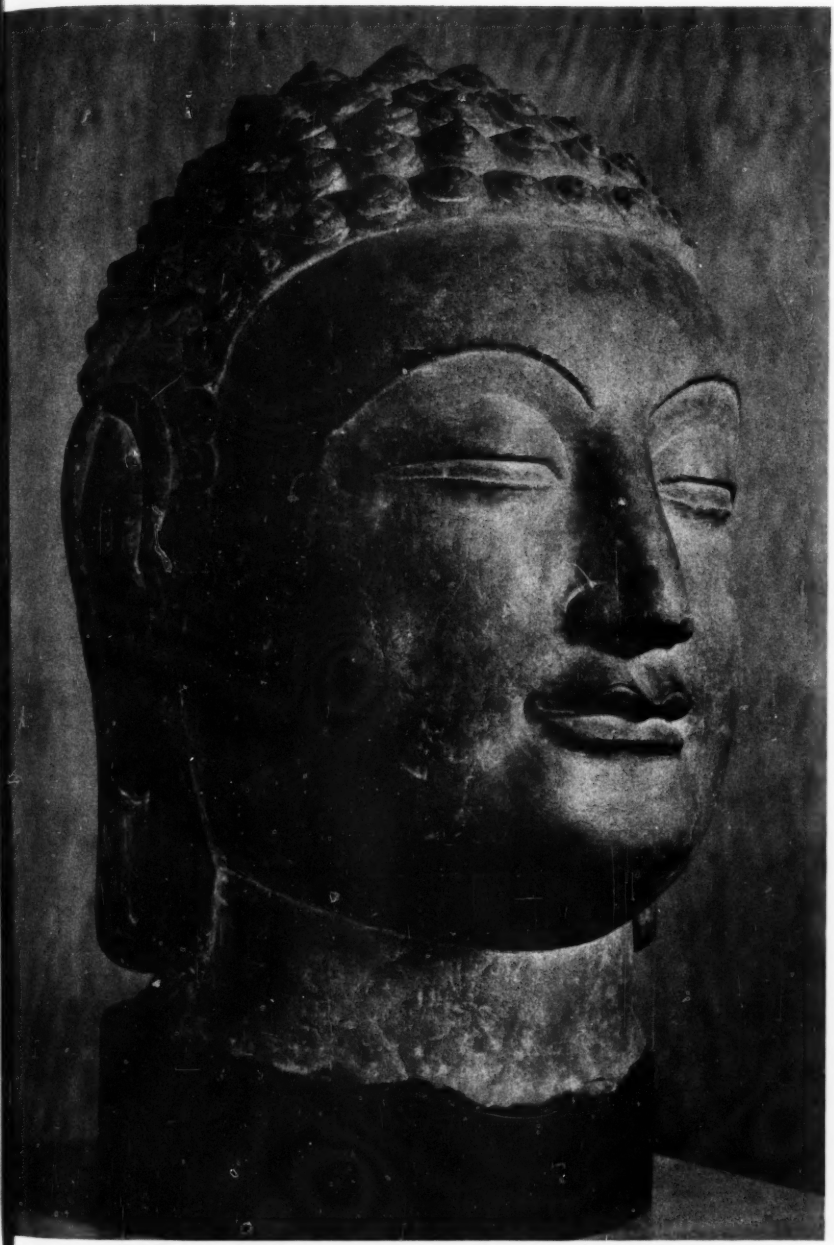
The history of art is a visual record of the philosophical concepts which have engrossed creative thinkers of each age. In their works the artists leave behind them both the history of their personal reactions and an accurate barometric reading of their intellectual climate. Recognition is instantaneous and universal. It does not require any act of intuition or special gifts of birth or education to experience it. Anyone who looks at a picture, a statue, or the architecture of a building learns instinctively and immediately something of the world which produced it. What will the art of

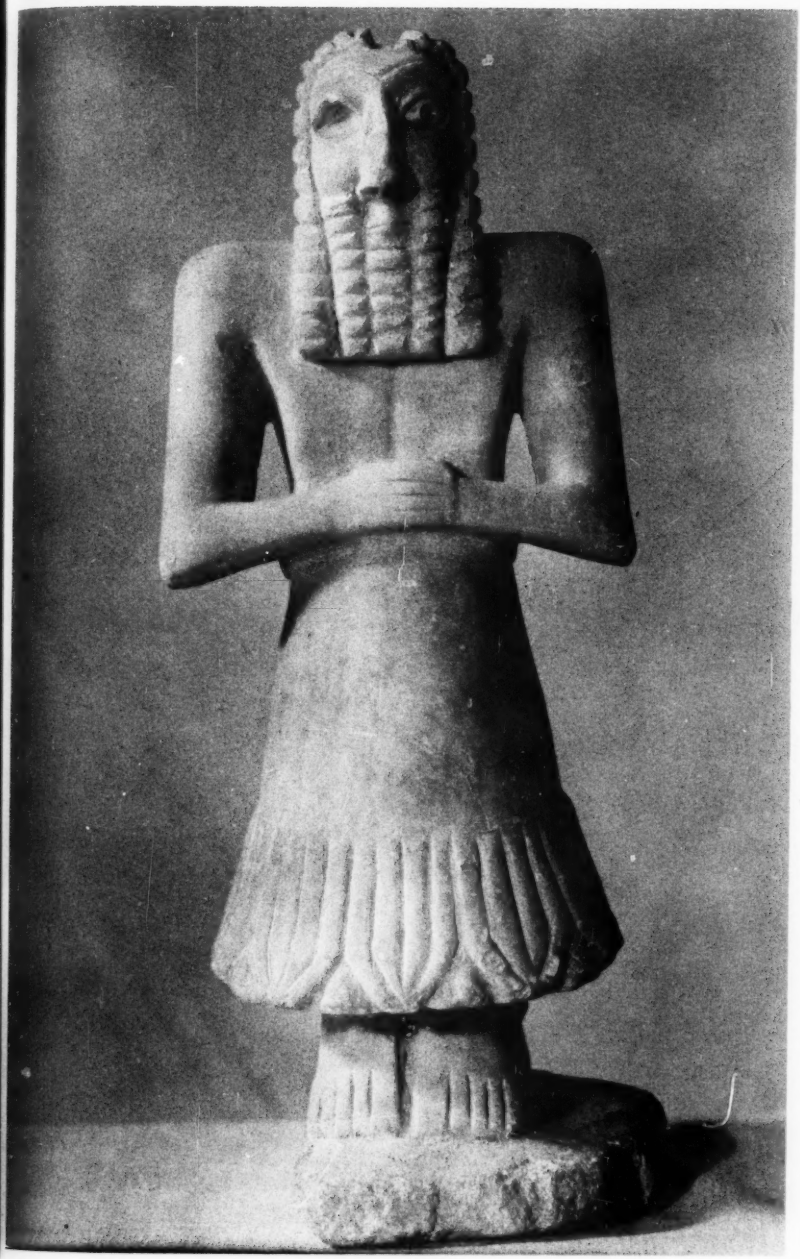
HEAD IN CARVED EBONY FROM THE CONGO
African, Ninteenth Century A. D.
Formerly in a private collection in Berlin

SULKA MASK FROM NEW POMERANIA
Oceanic, Nineteenth Century A. D.
Formerly in the Museum für Volkerkunde, Leipzig



HEAD OF BUDDHA FROM A CAVE TEMPLE
AT LUNG MEN
Chinese, T'ang Dynasty, 618-906 A. D.
Worcester Art Museum

STONE HEAD OF CORN GODDESS FROM
COPAN, HONDURAS
Mayan, Sixth Century A. D.
The Peabody Museum, Harvard University



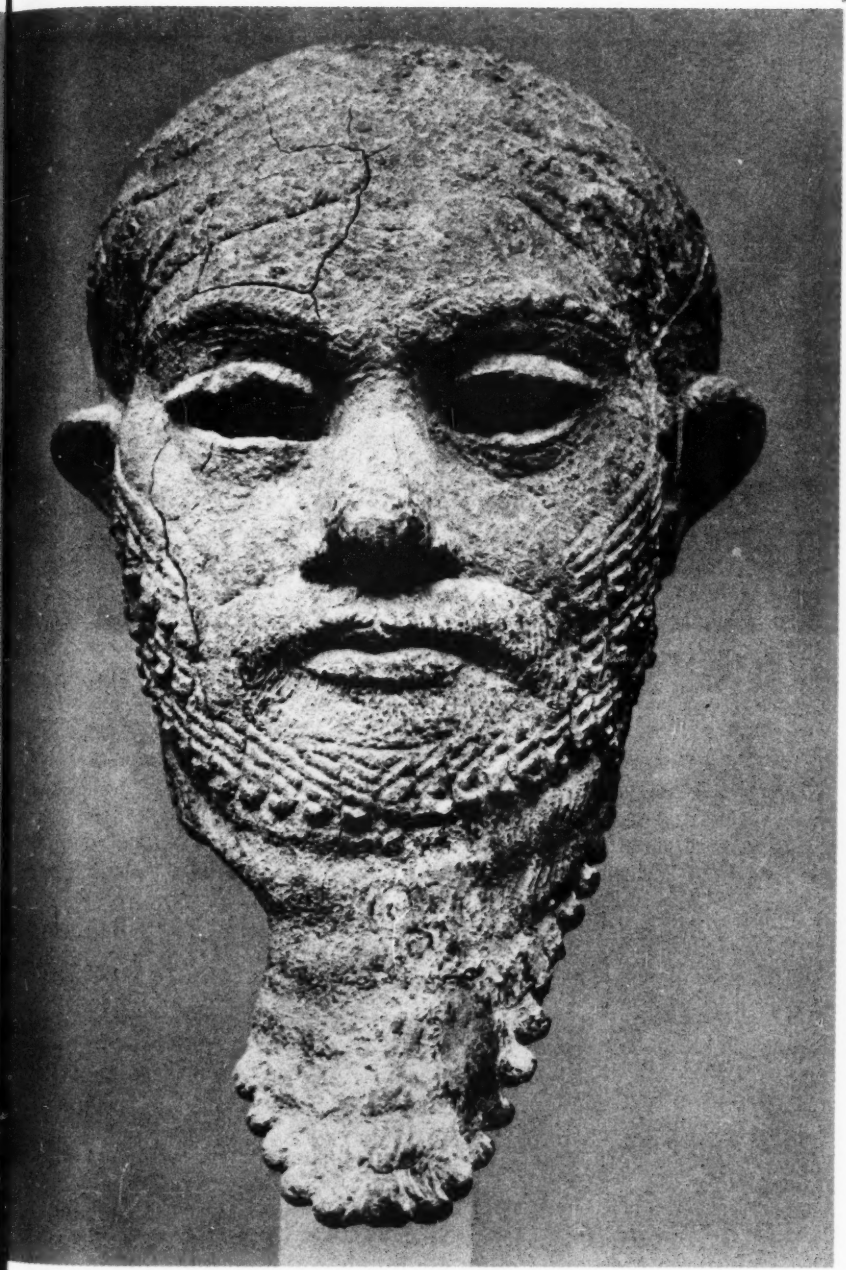
LIMESTONE STATUETTE OF A DIVINITY
FROM KHAFAJE

Sumerian, c. 3000 B. C., from the excavations of the University of Pennsylvania
Worcester Art Museum

COLOSSAL HEAD OF A DIVINITY
Cypriotic, Sixth Century A. D.
Worcester Art Museum

PAINTED LIMESTONE PORTRAIT OF PRINCE ANKH-HAF
"The Red Man," Egyptian, Fourth Dynasty, 2840-2680 B. C.
Boston, The Museum of Fine Arts

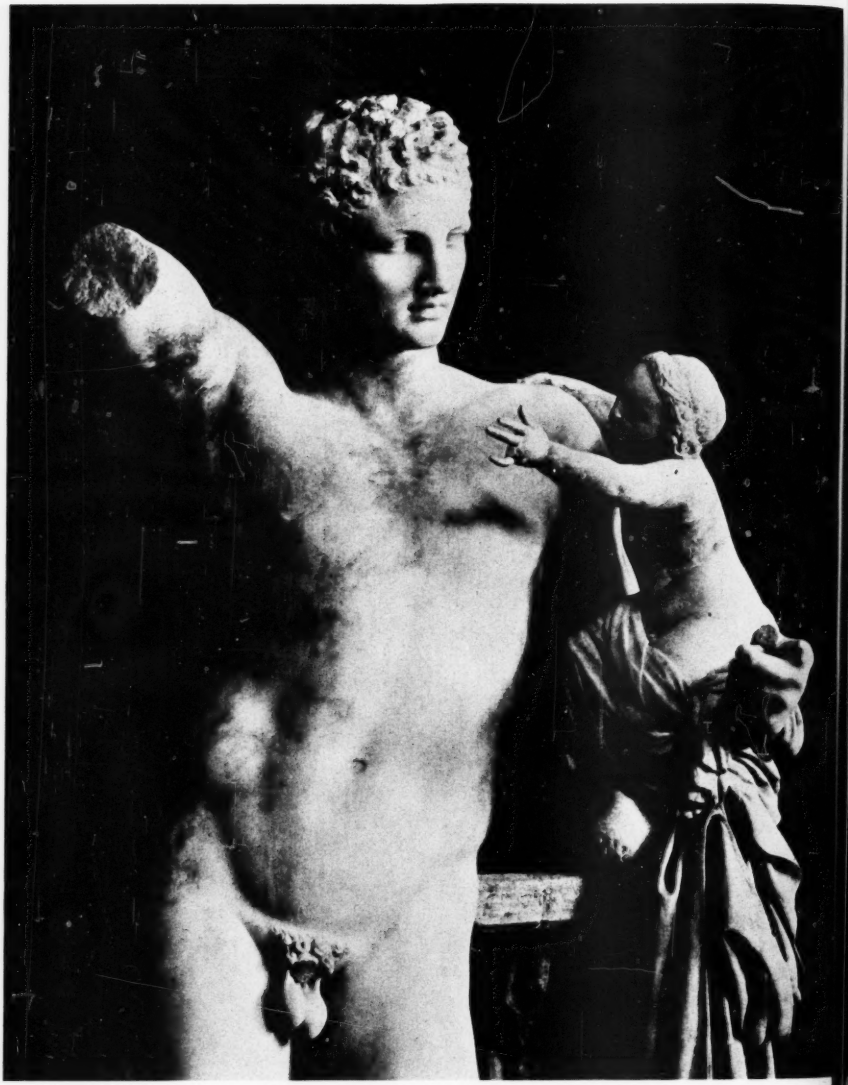
LIMESTONE HEAD OF A WINGED BULL
Assyrian, late Ninth Century B. C.
The British Museum



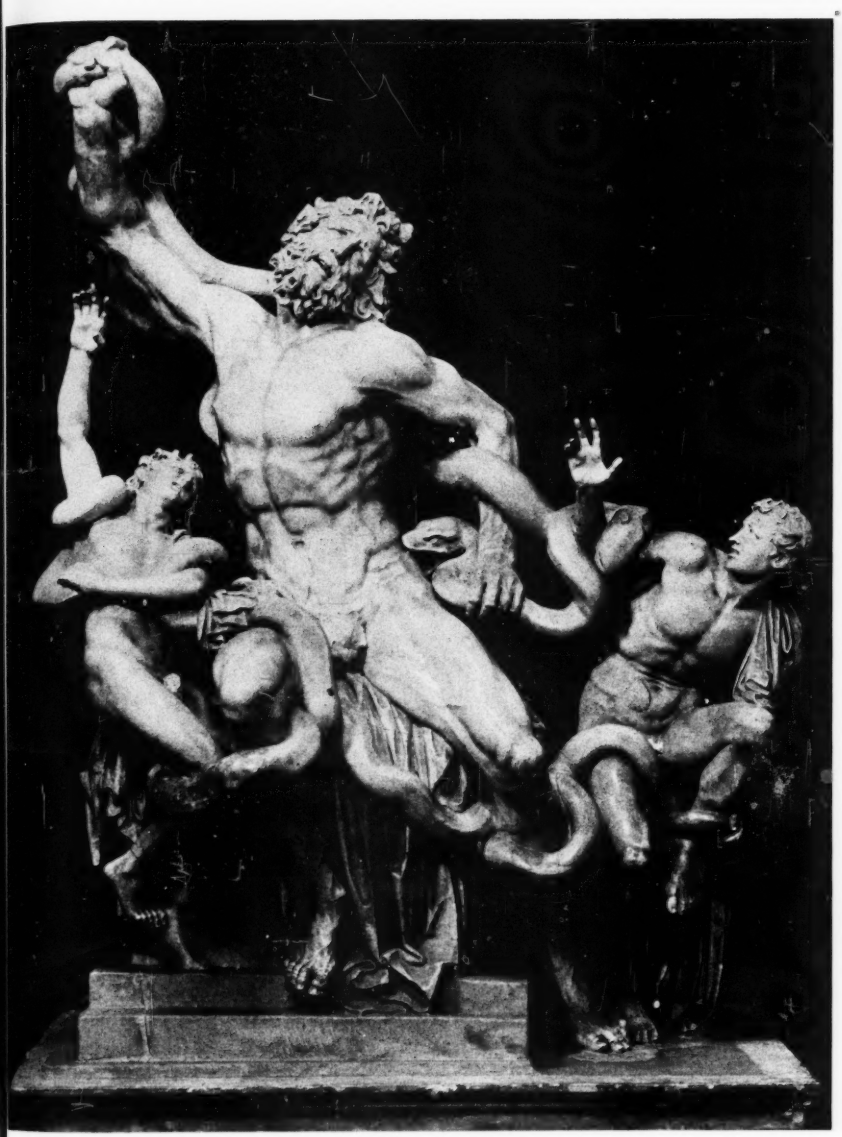
COLOSSAL BRONZE HEAD
Mesopotamian, Prehistoric, Third Millennium B. C.
New York, The Metropolitan Museum of Art

MARBLE STATUE OF A KORÉ FROM THE ACROPOLIS
Greek, Archaic Style, late Sixth Century B. C.
Athens, The Acropolis Museum

THE CHARIOTEER OF DELPHI
Archaic bronze statue, Greek, c. 476 B. C.
The Museum of Delphi



THE HERMES OF PRAXITELES (DETAIL)
Greek, by Praxiteles of Athens, c. 343 B. C.
The Museum of Olympia



THE LAOCOÖN

Made in Rome c. 25 B. C. by Greek sculptors from Rhodes

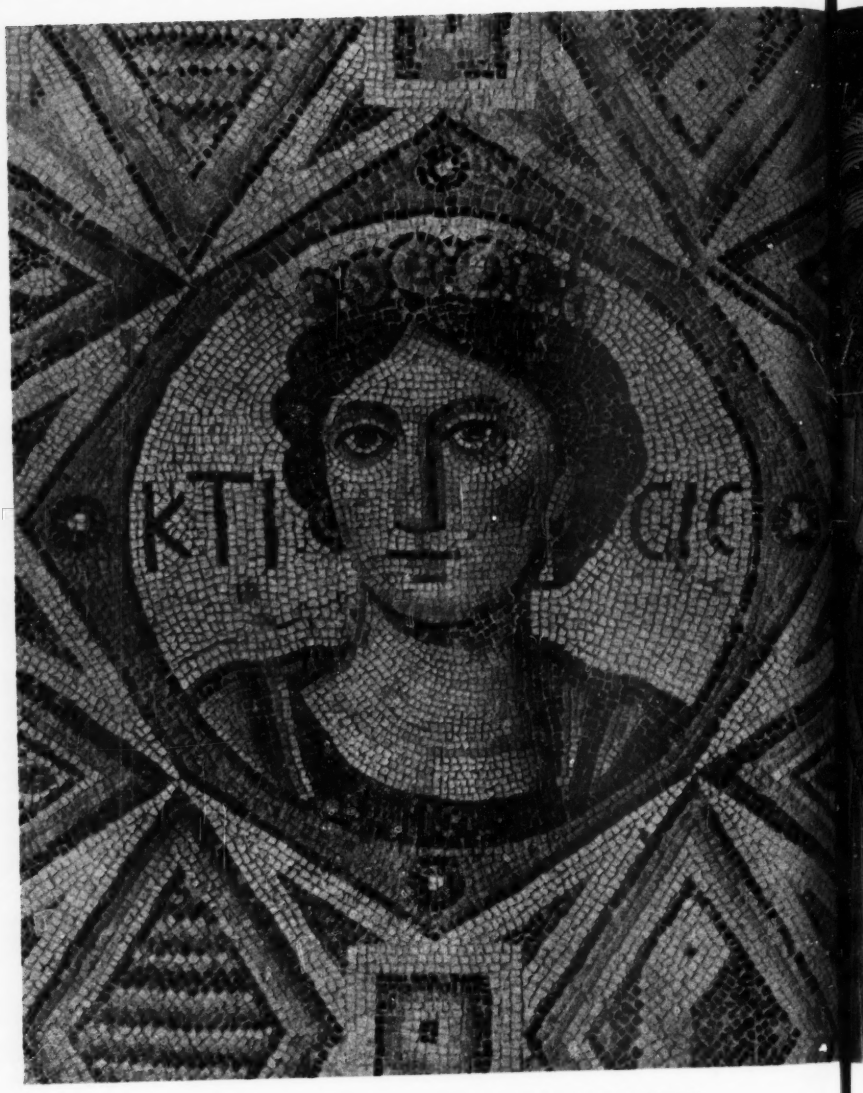
The Vatican

DEMETRIUS I, KING OF SYRIA (162-150 B. C.)
Hellenistic bronze by a Greek sculptor found in Rome
Rome, Terme Museum

THE EMPEROR CALIGULA
Roman portrait head, First Century A. D.
Worcester Art Museum

HEAD FROM A POLYCHROME WOODEN CRUCIFIX
Romanesque, French, Twelfth Century A. D.
Formerly in a private collection in Paris

"LE BEAU DIEU"
French, Gothic, Thirteenth Century A. D.
Detail of a statue of Christ in the Cathedral of Amiens



KTISIS THE GODDESS OF FOUNDATION

Detail from a mosaic in a villa at Antioch, Syria, Fifth Century A. D.
Worcester Art Museum

THE VIRGIN WEEPING AT THE FOOT OF THE CROSS
Detail from a late Thirteenth Century fresco from Spoleto, Italy
Worcester Art Museum

PORTRAIT OF A MAN IN A TURBAN
By Jan van Eyck, c. 1430 A. D.
London, The National Gallery

FREDERIGO DA MONTEFELTRO, DUKE OF URBINO
By Piero della Francesca, Italian, c. 1450 A. D.
Florence, The Uffizzi

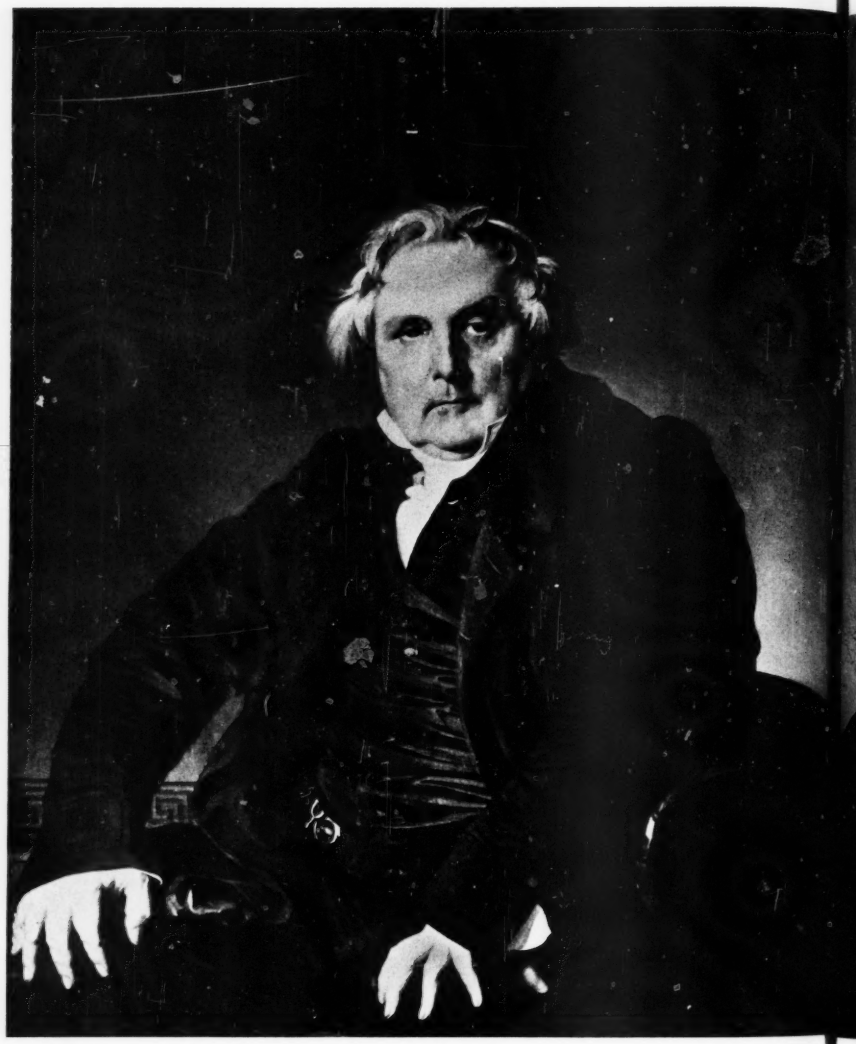
POPE INNOCENT X

By Velasquez, Spanish, Seventeenth Century A. D.
Rome, The Doria Gallery

PIETRO ARETINO
By Titian, Italian, Sixteenth Century A. D.
New York, The Frick Collection

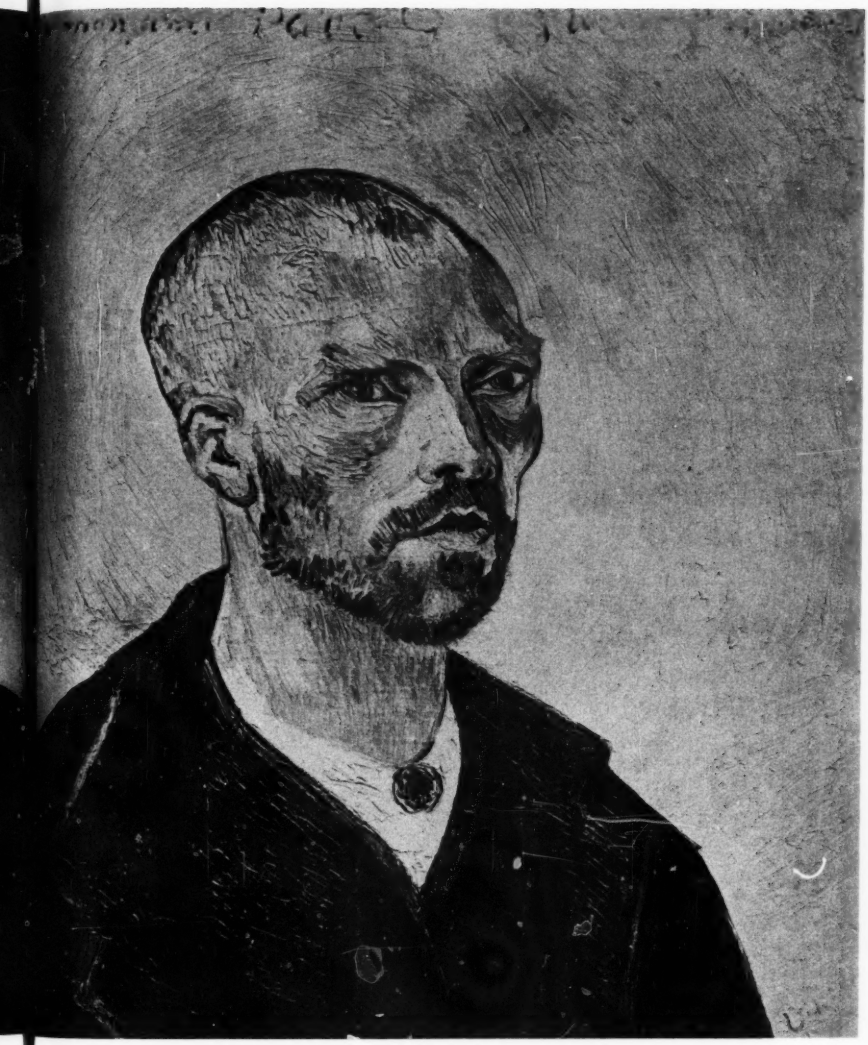
ARISTOTLE WITH A HEAD OF HOMER
By Rembrandt, Dutch, Seventeenth Century A. D.
New York, Private Collection

WOMAN WITH CHRYSANTHEMUMS
By Degas, French, Last Quarter Nineteenth Century A. D.
New York, The Metropolitan Museum of Art



ÉMILE BERTIN

By Ingres, French, Second Quarter Nineteenth Century A. D.
Paris, The Louvre



SELF-PORTRAIT OF THE ARTIST
By van Gogh, Dutch, Last Quarter Nineteenth Century A. D.
Fogg Art Museum, Harvard University

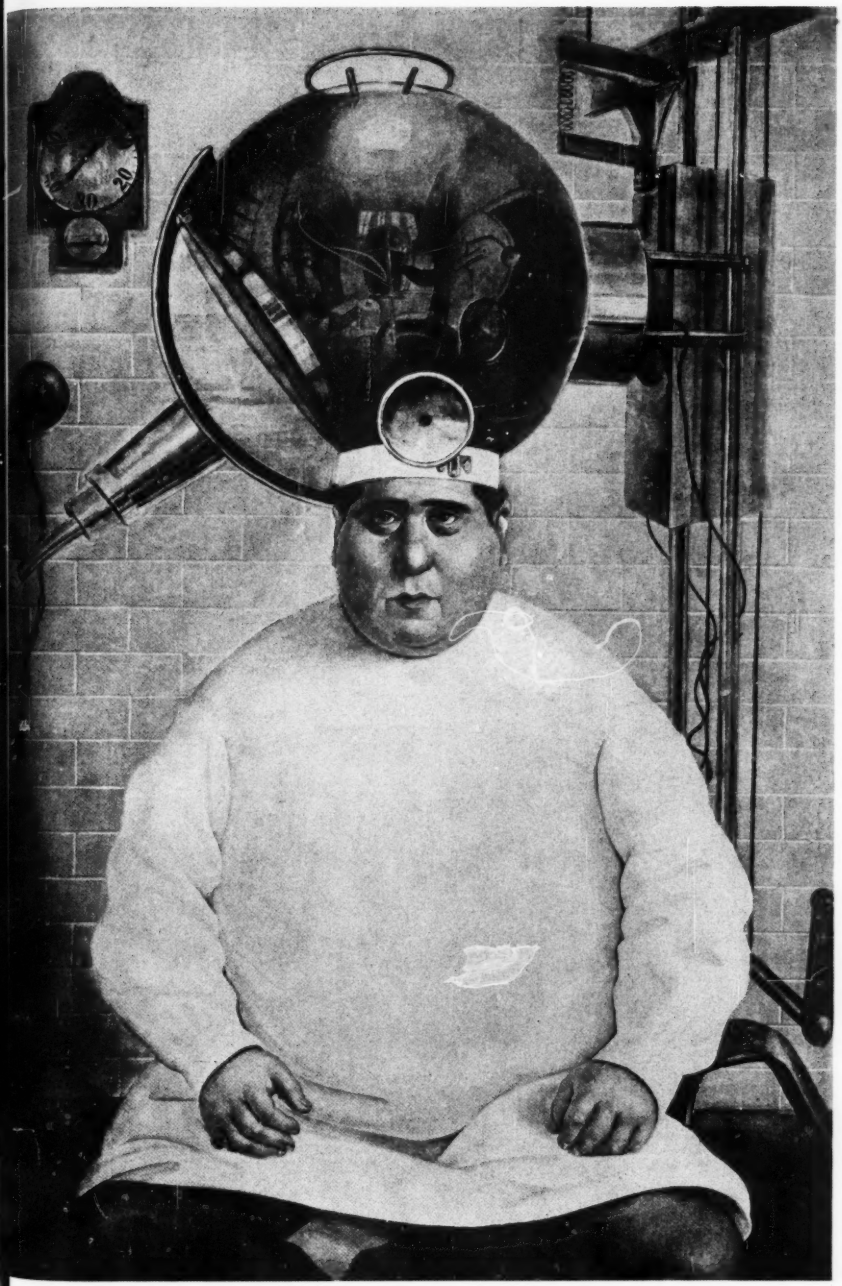
OIL STUDY FOR THE CARD PLAYERS

By Cézanne, French, Last Quarter Nineteenth Century A. D.

Worcester Art Museum

SIR WINSTON CHURCHILL
By Graham Sutherland, English, 1955
London, House of Commons (World Wide Photo, A.P.)

THE TWO MUSICIANS
By Max Weber, American, 1917
New York, The Museum of Modern Art



THE DOCTOR
By Otto Dix, German, 1926
New York, The Museum of Modern Art

GIRL BEFORE MIRROR
By Picasso, French, 1932
New York, The Museum of Modern Art

today tell the spectator of tomorrow? The answer is not an easy one, but at least it will have the perhaps questionable validity of being recognized as the product of its time.

If we accept the definition of art as the rendering of truth in sensible form, and truth as the interpretation of human experience, it is obvious that *a work of art is essentially communicative. It must mean something to someone other than the person who created it – in fact, and more important still, it can mean the same thing or several different things to a number of persons. But meaning it must have.* Not until the second quarter of the twentieth century was the essential communicability of art ever denied. Communication has been common to all the great racial traditions and, once established, can take any variety of expressions. It is unlimited in content or subject matter, free to adopt any style or technique. The one and only quality denied a work of art throughout the ages is privacy. Unless participation is allowed the spectator, it becomes a hopeless riddle and ceases to be a work of art at all.

André Gide confirmed this point of view in a little known book on the art of Poussin. He said:

> I want to be clearly understood. What I do not care for is to hear the categorical declaration: *by virtue of its very absence of subject matter, this is the true painting;* to see painting stripped naked of every spiritual virtue for the sake of placing a higher premium exclusively on the qualities of craftsmanship; to see our greatest painters of today take care to address themselves only to the senses, to be nothing more than the eye and the pencil. This penury, this voluntary bankruptcy, will remain, I believe, the characteristic of our time, an epoch without hierarchy, which later runs the risk of being severely judged, the more so because the painters themselves by reason of their skill are so admirable. It is by their very *insignificance* that the works painted in our epoch shall be recognized.[14]

If the artist is obligated to communicate his meaning, the public in return should bear in mind that they are no less obligated to make an effort to understand what the artist is attempting to say to them. The message of art is not necessarily a simple message or an

[14]The reader may find some satisfaction in reading two recent books in which the philosophy of abstract art is fully discussed: Frances Bradshaw Blanshard, *Retreat from Likeness in the Theory of Painting* (New York: Columbia University Press, 1949), and Charles-Pierre Bru, *Esthétique de l'abstraction: Essai sur le problème actuel de la peinture* (Paris: Presses Universitaires de France, Privat, 1955).

easy one; and it is quite legitimate that a painting or a statue be meaningless to persons at one level of education and yet be clear and explicit to those at another level, who are particularly trained to understand it. The same layman who takes offense at an abstract picture in an exhibition, into which the artist has put years of self-discipline in logical and orderly arrangement of abstract or theoretical ideas, will accept without question the right of a university or a research foundation to publish abstruse mathematical conclusions and equations which, as an untrained person, he can never hope to comprehend. In the sciences, in the social sciences, and in the humanities there is a general acceptance of the fact that certain studies are reserved for the higher intellect. Unfortunately this is not true in the arts.

It is, however, this very appeal to the higher intellect in the early works of such masters as Picasso, Braque, Matisse, and Paul Klee which has had such influence on the present generation. For the art of the past fifty years has been more an art of cerebration than one of reflective and constructive thought. Absorption in technical experiment and the influence of psychiatric and physical investigation have engrossed the larger and more experimental minds. Picasso's startling quality of revelation, actually a revaluation of the art of seeing, has come through excessive introspection and cynicism to do a terrible disservice to those younger artists who lack his extraordinary talents and mercurial virtuosity. Whether or not one likes the message these larger talents are communicating, whether one thinks them good or evil, or prophetic of destruction or nihilistic in their purpose, one must nevertheless admit that they do at least communicate a message of importance to the present day.

That this message is more often than not a message of propaganda for some popular and current ideology is, of course, one of the fundamental dangers inherent in the modern movement. But Picasso, even when he is most socially destructive, is free from the charge of producing something meaningless or utterly private in its concept. As the storm center of the contemporary movement, he has become the symbol in the public mind of what is good or bad in modern art. Yet few of the visitors to an exhibition who are not trained in the history of design realize the fundamental significance of his contribution to the thought of our time.

To trace the growth of Picasso, in the avalanche of publications devoted to his art, is merely to recognize his almost unearthly power.

Yet, despite his undeniable genius, one detects in his latest work "the most brilliant, the most deadly parody of art ever created by man or devil." "Picasso," an English critic, Michael Ayrton, has said, "has sucked the history of painting dry and built a monument with its bones . . . his work is a superlative paraphrase of art." Everything which he has produced has been in effect a criticism of some previous style or attitude of man toward art. Leaping from style to style – from archaic Greek to Romanesque and back again to Oceania – he has carried art criticism to a pinnacle never before known and in so doing has disturbed profoundly men of talent less nimble-witted than himself.

Picasso, at once the giant paradox and the towering genius of our day, captures our imagination by exploiting the manic depression which has carried our generation through two world wars and is hurling us along the road to world revolution. He has caught our suicidal despair and laughed at it hysterically. Only history can determine whether Picasso, like the skeleton at the feast, is the last flowering of a civilization whose collapse amuses him, or whether there is latent in his extraordinary mobility of line and color the prophecy of a new world which is to come.

If Picasso, with his uncommon gifts, has often shown contempt for the dignity of man, one can scarcely expect much more from those lesser luminaries on both sides of the Atlantic who slavishly follow in his footsteps. Whereas it is clear that Picasso is always completely master of himself, and knows to a carefully calculated nicety what he is doing, his imitators are capable of producing only the empty forms but not the content. Much that has become unintelligible to the spectator in contemporary art fails in communication solely because the artist-imitator does not himself comprehend the meanings of forms and techniques he has borrowed from other artists. We are too often confronted, therefore, with second-rate minds mouthing secondhand ideas. The modern movement has become a vast public *monte di pietà* – a pawn shop – in which the pseudo scientists and psychiatrists of Greenwich Village have so often found an outlet for the nonobjective plagiarism of machine design and the diverting, pornographic possibilities of Dr. Freud.

From the ashes of the present day conflict between Man and Science bitternesses have been unleashed which had been unknown since the religious wars of the Renaissance and the Reformation. Aesthetic issues are now inextricably confused with social ethics,

and whereas the average citizen is obsessed with the necessity of reasserting his responsibility to other individuals, the artist has taken refuge in a symbolic language whose symbolism applies only to his own confined and limited experience.

For some years reaction against this privacy in the arts has been gaining ground, and already the handwriting of heresy is on the wall. Eight or ten years ago the Institute of Modern Art in Boston changed its name to the Institute of Contemporary Art because " 'Modern Art,' an innocent phrase, denoting simply the art of our times, came to signify for millions something unintelligible, even meaningless. . . . 'Modern Art' describes a style which has become both dated and academic." This manifesto was not an isolated shot. Ortega y Gasset, the celebrated author of *The Revolt of the Masses*, had predicted a quarter century earlier that the new style was condemned to sterility. Now published in English as *The Dehumanization of Art*, his essay confirms once more that the modernists, by their insistence on avoiding living forms and by their dependence upon the ironical and inconsequential, have "changed the position of the work of art in the hierarchy of human interests and activities."

To humiliate and patronize the masses with an art which can be deciphered only by an intellectual elite – the fashionably initiated – must inevitably arouse a people's antagonism and their indignation. Ortega continues:

> Through its mere presence, the art of the young compels the average citizen to realize that he is just this – the average citizen, a creature incapable of receiving the sacrament of art, blind and deaf to pure beauty. . . . But such a thing cannot be done after a hundred years of adulation of the masses and apotheosis of the people. Accustomed to ruling supreme, the masses feel that the new art, which is the art of a privileged aristocracy of the finer senses, endangers their rights as men.

Ortega goes on to show that what is appearing today is merely a logical and inexorable evolution rather than a revolution in the arts:

> The guiding law of the great variations in painting is one of disturbing simplicity. First things are painted; then sensations; finally ideas. This means that in the beginning the artist's attention was fixed on external reality; then on the subjective; finally on the intra-subjective. . . . It is possible that present day art has little aesthetic value, but he who sees in it only a caprice may be sure that he has not understood either the new art or the old. Evolution has conducted painting – and art in general – inexorably, fatally, to what it is today.

Another equally exclusive orthodoxy has been substituted for the old. While the "wild beasts" of the early years of the twentieth century have established themselves firmly upon classical ground, the conservatives have become the new heretics whom the left wing critics are busily burning at the stake. The totalitarianism of the National Academy of Design, which dominated the American scene for well over a hundred years, is now so impotent and toothless that its senility borders on the quaint and antiquarian. The Academicians themselves – particularly the younger ones – are searching their own souls and opening windows that long were closed to contemporary ideas and techniques. Since they no longer have a position which in the eyes of the outside world is defensible, they can now afford to experiment with forms and realities which are based upon human experiences and which have withstood the tests of time. They are, moreover, free to accept, without violating any code or a priori judgments, whatever forms or notions which it pleases them to adopt. To the degree that their traditional trade union has been humiliated and discredited, as individuals they have at long last recovered the freedom of the brush. Perhaps the bitterest irony today in the world of art is the spectacle of men and women, well past middle age, who more than thirty years ago had fought and won the battle of modern art, defending artistic properties which have become sterile and obsolete. What the new Academy of the Left has yet to realize is that in their fanatic zeal they have not achieved freedom of movement for the modern artist. They have merely substituted the rubber girdle for the whalebone corset.

If the Academy of the Left appears for the moment to have vanquished the field, it would none the less be folly to condemn the many hundreds of its adherents who are seeking an escape from the technocracy and introspection of the world in which we live. That their statements may be obscure is not sufficient reason for suspecting the sincerity of their motives. Too often they are swept off their feet by the fashionable curiosities of their more successful contemporaries, and their personal tastes and convictions are beaten down by the avalanche of exhibition catalogues and art magazines which come pouring to their studios, diverting their attention from their own innate visions to fritter away their talents in the pursuit of the ephemeral and inconsequential. Only the very strong are able to resist. For the painter, as Graham Sutherland has pointed out, "is a kind of blotting-paper; he soaks up impressions – goes through

'periods of fullness and evacuation'; and he is very much part of the world. He cannot, therefore, avoid soaking up the implications of the outer chaos of the twentieth century. . . ." The artist's message cannot be ignored, for if he is a person of any considerable stature he is a dedicated being speaking from the inner recesses of his soul.

But it is not necessarily the greatest artists who set the tone of any epoch; they are exploited by their slavish imitators, the pygmies and the Picassini, whose thinking for the most part has been predicated on the education of the Mock Turtle who went to school in the sea. This, it will be recalled, consisted of "Reeling and Writhing to begin with, the different branches of Arithmetic – Ambition, Distraction, Uglification, and Derision." There were the attendant disciplines, "Mystery, ancient and modern, Seaography, Drawling, Stretching, and Fainting in Coils," but poor Alice never quite mastered the curriculum for, like the Gryphon, she was too busy learning "Laughing and Grief from the classical master."

The art of our time has thus been characterized by the never ending struggle of the modern movement, as Cyril Connolly wrote,

> between man betrayed by science, bereft of religion, deserted by the pleasant imaginings of humanism against the blind fate of which he is so expertly conscious. "Nothing dreadful is ever done with, no bad thing gets any better; you can't be too serious!" This is the message of the Forties, from which, alas, there seems no escape, for it is closing time in the gardens of the West and from now on an artist will be judged only by the resonance of his solitude or the quality of his despair.[15]

Despair, indeed, appears to be perhaps the most familiar trademark of the contemporary artist – a despair springing not so much from a sense of hopelessness, but from his echoing and engulfing loneliness. He luxuriates in being "*The Outsider.*" The adjustment to society and to the life and people about him, which was the very quality which in the past brought the artist into direct and intimate contact with his audience, seems to have slipped away from him, and he is creating in a vacuum. Since there is no one to whom he is conscious of imparting the meaning of his work, he feels compelled to attract attention to himself by being original. With the essential communication of his work denied him, he automatically falls back

[15] From the valedictory editorial of *Horizon*, vol. XX, Nos. 120-121, December 1949-February 1950.

upon himself and those aspects of his inner life which, prior to the advent of abnormal psychology, were seldom exposed to view. The style or manner in which these private thoughts are privately expressed becomes more important to him than the quality or content of the thoughts themselves. He falls into the abyss of an encompassing and encyclopedic eclecticism in which even his most skillful borrowings are stamped with his own personality. Yet he cannot be content to mirror his own soul. It must reveal the torment and the particular revolt of the moment to which the artist feels obliged to subscribe. This revolt has ceased, however, to be an indignant protest against the sins of the past and of the present but has become instead a sort of generator of perpetual motion. Where we once had "art for art's sake," we now have "revolution for revolution's sake" – an equally sterile end in itself. The physical and intellectual fatigue produced by this incessant artistic flagellation has raised the new Academy of the Left to a level of banality and overstatement not achieved in art since Versailles in the days of Lebrun and the *Grand Monarque*.

* * * * *

Clearly the artist and the scientist are agreed upon the limitations of our present world, and both feel compelled to cast their observations in terms of the health of the body politic. Too much has already been said about the political overtones of contemporary art. In such intemperate attacks as those made by self-appointed minutemen of one kind or another, the baby is thrown out with the bath. The witch hunt that has harassed our American universities in recent years is unfortunately spreading its net for the creative artists, and the uninformed layman, who is suddenly confronted with an art which he does not understand, is beguiled into reading into it an attack upon his accustomed way of life, when actually the artist, more often than not, is merely voicing in different terms the anxiety for daily existence and the immediate future which they share. Not only has the atom been split in our time, but man's conscience has been rent asunder; and if the artist or the writer, no less than the teacher, is shocked at the material irresponsibility he sees on every side he should be allowed to voice his concern without being accused of being a propagandist for other people's ideologies.

Individualism, the type of fearless, rugged individualism which despite its many faults created the capitalist world in which we live,

alone can give the artist the confidence which he must have to express his inner thoughts and feelings. And it is neither necessary nor wise for him to align himself with partisan convictions or political ideologies. Academies and societies which veer to the left or to the right, far from being the guardians of an immortal tradition, are merely the tools of pressure groups whose greatest fear is fear itself.

The artists, who too often suffer from an exaggerated sense of timeliness, are really no different from the world in which they live. They are usually persons of limited experience in world affairs. Politically, economically, and socially they are children – visionaries with about as much practical sense as you will find among any group of cloistered individuals, whether they be members of religious orders or nuclear physicists working in restricted laboratories. Consequently what they know of the world is only what they glean from magazines and newspapers. The fact that they are frightened and insecure, and visionary, in their protests against a society in which they no longer feel at home is one of the inevitable tragedies of a generation which has gone through two world wars and a depression. What they are voicing is the terrible inadequacy of individual man in a mechanistic age, and it does not mean that in doing so they necessarily subscribe to any political or ideological conspiracy. They are merely lonely and frequently despairing men and women who are trying to express in plastic terms their personal and intimate reactions to world phenomena that they are ill equipped to understand. They fail to see in our present civilization the changeless values which have marked the great pages of history. What they really need is a little old-fashioned Dutch courage to face the future and the encouragement made possible only by the sympathetic understanding of the lay public. Look on the artists, if you must, as particularly gifted children but not as political monsters. They are far too naïve and disorganized to harm anybody but themselves.

There are those who may wonder where individualism will end and authority begin. Authority will inevitably lie within the work of art itself, in its "internal order," which E. M. Forster[16] insists stands up by itself as nothing else does:

> It achieves something which has often been promised by society but always delusively. Ancient Athens made a mess – but the Antigone

[16] "Art for Art's Sake" in *Two Cheers for Democracy* (New York: Harcourt, Brace and Company, 1951).

stands up. Renaissance Rome made a mess – but the ceiling of the Sistine got painted; Louis XIV made a mess – but there was Phèdre. Louis XV continued it, but Voltaire got his letters written. . . . Art is the one orderly product which our muddling race has produced. It is the cry of a thousand sentinels, the echo from a thousand labyrinths, it is the lighthouse which cannot be hidden; *c'est le meilleur témoignage que nous puissions donner de notre dignité.*

Just what the nature of this internal authority should be is a question that has occupied the waking hours of many thoughtful artists and connoisseurs. Wilenski, the English critic, has declared that "to be an original enlargement of an artist's experience a work of art must be called forth by the service of religion or some consciously held idea of art." What then is this consciously held idea? "To regain a creative consciousness both in the artist and the spectator." He accepts religious art without comment as votive and therefore originally conceived; it is the product of a common emotional experience. Nonreligious art, however, must be dominated by a principle – a knowledge held jointly by the creator and the spectator. Call it structure, composition, what you will. It is the fundamental discipline underlying the creative process – a process which is instinctive and universal, something shared with the biological world in its innate order, balance, symmetry.

Many people are inclined to ask how it is possible to recognize these spiritual qualities in a new and sometimes strange creative work. "I wish," they say, "that I could see what you see in that picture." Without defining art it is tempting to reply that we learn to know and estimate art in the same way that we learn to appreciate our friends. There are those among our acquaintance whom we love and others whom we cordially despise; some will convey a special sympathy, while others appeal only to the rational processes of our minds. Since works of art are the creation of human beings, they must be looked upon as extensions into stone or canvas of the artist's personality. And our insight into their characters is based upon the same human experience of constant association that we gain by living with our fellow men.

Perhaps the artist's unique gift is to see beyond the narrow reality of the moment into the breadth of eternity. This is superbly expressed in the words attributed to the Chinese philosopher Li Po, who wrote and painted at the court of the Emperor Ming Huang in the eighth century:

I would not paint a face, a rock, nor brooks nor trees,
Mere semblances of things, but something more than these.
I would not play a tune upon the sheng or lute,
Something that did not sing meanings that else were mute.
That art is best which to the soul's range gives no bound,
Something besides the form, something beyond the sound.

These lines were brought to the attention of Miss Helen Keller some years ago by a painter who was taking her portrait. Talking with her as she sat to him, he became amazed at her understanding of the artist's point of view. He sent this poem to her on a Christmas card, to which she made a very beautiful reply:

Li Po's amazingly modern lines on art, which I have now in Braille, seem to me to describe the sincerity which I perceive emerging from the present ordeal like gold tried in the furnace. Eagerness for life's realities and not "mere semblances of things" breathes through what I read not only about art but also spiritual experience, literature and the demands for a freer, juster, friendlier world. Although it is true that another civilization has gone bankrupt, I am not dismayed. God never leaves us without visions of the future and discoveries of greater possibilities in human nature that shall keep us enthusiastic. We are being made aware of a coming social order larger, nobler than our own, and the crusade of goodness and intelligence against ignorance and wicked passions must needs end in unfeigned good-will radiating through all earth's systems.

Progress and catastrophe. The answer lies in our hearts rather than in our intellects. Standing on the threshold of a new and infinitely more productive world from which national and international suicide is separated by only the thinnest and most fragile membrane, we who have derived so much from our inherited civilization are obligated to give it another chance. The artist, then, if he chooses to retain his stature as prophet, must reassert his belief in man.

Revelation of the universe is not to be had merely for the asking. It requires humility and faith – faith in man and some acceptance of a divine order more considerable than the petty emotional experiences of man himself. The artist will find this faith in art and in the writings of the great men of the past: in van Gogh's letters and in Delacroix's *Journal*, in the sonnets of Michelangelo and Cézanne's confessions to Zola. To create a man must give himself; and if he gives himself, he must believe. Then and only then will his work shine with the contentment of the archaic smile.

Rumford Medal Lecture 1957

Thermal Convection

S. CHANDRASEKHAR

I. INTRODUCTION

THE SIMPLEST example of thermally induced convection arises when a horizontal layer of fluid is heated from below and an adverse temperature gradient is maintained. The adjective "adverse" is used to qualify the prevailing temperature gradient, since, on account of thermal expansion, the fluid at the bottom becomes lighter than the fluid at the top; and this is a top-heavy arrangement which is potentially unstable. Under these circumstances the fluid will try to redistribute itself to redress this weakness in its arrangement. This is how thermal convection originates: It represents the efforts of the fluid to restore to itself some degree of stability. These basic facts concerning thermally induced convection were discovered by Count Rumford when he observed that currents were set up in the bore of a large thermometer which he had been using in an experiment. I am indebted to Professor Sanborn Brown for the following extract from Count Rumford's writings, in which his discovery is announced:

> I saw the whole mass of the liquid in the tube in a most rapid motion running swiftly in two opposite directions, up and down at the same time. The bulb of the thermometer, which is of copper, had been made two years before I found leisure to begin my experiments, and having been left unfilled without being closed with a stopple, some fine particles of dust had found their way into it and these particles which were intimately mixed with the spirits of wine, on their being illuminated by the sun's beam, became perfectly visible . . . and by their motions discovered the violent motions by which the spirits of wine in the tube of the thermometer was agitated. . . . On examining the motion of the spirits of wine with a lens, I found that the ascending current occupied the axis of the tube and that it descended by the sides of the tube. On inclining the tube a little, the rising current moved out of the axis and occupied the side of the tube which was uppermost, while the descending currents occupied the whole of the lower side of it.

However, as everyone has known since King Alfred's time, one cannot always depend on thermally induced circulation to prevent burning at the bottom! The reason is, the natural tendency of the fluid to react instantly to its unstable arrangement is inhibited by its own viscosity, and the more viscous the fluid, the less agile is it to react to its potential instability.

The first quantitative experiments to establish the extent to which viscosity inhibits the onset of instability, and to determine the precise manner in which instability does set in, are those of Bénard at the turn of the century. Bénard worked with very thin layers of liquid (only about 1 mm. deep) standing on a leveled metallic plate which was maintained at a uniform temperature. The upper surface was usually free and, being in contact with air, was at a lower temperature. Various liquids were employed – and some, indeed, which would have been solid under ordinary conditions. Bénard's experiments established the following two fundamental facts: *First*, a certain critical temperature gradient has to be exceeded before instability can set in and, *second*, the motions which ensue on surpassing of the critical temperature gradient have a *cellular pattern*. What actually happens on the onset of instability is that the layer of liquid rapidly resolves itself into a number of cells which after a while become equal and regular and align themselves to form a beautiful hexagonal pattern. Figure 1 is a reproduction of an early photograph of Bénard's; Figure 2, which illustrates the same phenomenon by a different experimental arrangement, is taken from a paper by Schmidt and Milverton.

The correct interpretation of Bénard's experiments was given by Lord Rayleigh in 1916. Rayleigh showed that what decides the stability or otherwise of a fluid heated on the "underside" – as he expressed it – is the numerical value of the nondimensional parameter,

$$R = \frac{g\alpha\beta}{\kappa\nu} d^4 \qquad (1)$$

– now called the Rayleigh number – where g denotes the acceleration due to gravity, d the depth of the layer, $\beta = | dT / dZ |$ the constant adverse temperature gradient which is maintained, and α, κ, and ν are the coefficients of volume expansion, thermometric conductivity, and kinematic viscosity, respectively. Rayleigh showed that instability must set in when R exceeds a certain determinate

critical value R_c, and that when $R = R_c$ a stationary pattern of motions will come to prevail.

If β_c denotes the temperature gradient which must be exceeded for the occurrence of convection, then

$$\beta_c = R_c \frac{\kappa\nu}{g\alpha} d^{-4} \; ; \tag{2}$$

and, as we observe, this is higher the higher the viscosity.

In this lecture I want to consider especially the effects of rotation and magnetic field, separately and jointly, on the onset of thermal instability. However, to understand fully the meaning of the predicted effects, it is necessary that we have some appreciation of the manner in which instability under the circumstances envisaged can manifest itself, and how, indeed, one can calculate the critical Rayleigh number for the onset of instability. I shall, therefore, consider these aspects of the problem first.

II. ON THE TWO WAYS IN WHICH INSTABILITY CAN SET IN: AS CONVECTION AND AS OVERSTABILITY

Suppose, then, that an initial *static* state in which a certain adverse temperature gradient is maintained is slightly disturbed. We ask: Will the disturbance gradually die down and the original state be eventually restored? Or, will the disturbance grow in amplitude in such a way that the system progressively departs from the initial state and never reverts to it? If the latter should be the case, then the state we started from is clearly an unstable one. On the other hand, we cannot positively conclude stability if the former obtains, for, in order that we may consider the initial state as stable, it is necessary that not merely a particular disturbance, but all conceivable disturbances to which the state may be subject, be damped. The criterion for instability is, then, that there exist at least *one* mode of disturbance for which the system is unstable; and the criterion for stability is that there exist *no* mode of disturbance for which it is unstable. If all initial states are classified as stable or unstable according to these criteria, then the boundary (in the set theoretical sense) between these two classes of states in the manifold of all states will define a certain *marginal state*. By this definition, a marginal state is a state of *neutral stability*. The isolation and charac-

terization of the marginal state is clearly the prime object of an investigation on stability.

It is not necessary for our present purposes tc go into the details of the mathematical processes by which one specifies the marginal state, but it is important to recognize that marginal states can be one of two distinct kinds. The two kinds correspond to the two different ways in which the amplitude of a disturbance can grow or be damped (see figure 3). Thus if $A(t)$ denotes the amplitude of a disturbance, then its dependence on time can be either of the two kinds:

$$A(t) = A_0 e^{qt}, \tag{3}$$

or

$$A(t) = A_0 e^{qt} \cos pt, \tag{4}$$

where p and q are real. In either case, we shall have stability or instability according as q is negative or positive; in the former case (equation 3) the amplitude of the disturbance will be aperiodically damped or amplified; in the latter case (equation 4) the amplitudes of certain characteristic oscillations will be damped or amplified. In both cases the marginal state will be distinguished by $q = 0$, but with this essential difference: In case 3 the marginal state will exhibit a stationary pattern of motions, while in case 4 it will exhibit oscillatory motions with a certain characteristic frequency.

Quite generally, if at the onset of instability a stationary pattern of motions prevails, then one says that the *principle of the exchange of stabilities* is valid and that instability sets in as convection. On the other hand, if instability sets in via a marginal state of purely oscillatory motions, then one says (following Eddington) that one has a case of *overstability*. The use of the term overstability in this connection is not entirely common. So it may be worth recalling Eddington's own definition of that term: "In the usual kinds of *instability* a slight displacement provokes restoring forces tending away from equilibrium; in *overstability* it provokes restoring forces so strong as to overshoot the corresponding position on the other side of equilibrium."

One final general remark: Since stability means stability with respect to all possible disturbances, it is clear that for an investigation of the stability of a system to be complete, it is necessary that the reaction of the system to all possible disturbances be examined. In practice one accomplishes this by expressing an arbitrary disturb-

Prandtl length can be used as the wave length of the disturbance too.

ance as a superposition of certain basic possible modes and examining the stability of the system with respect to each of these modes. Thus, in the problem of the stability of a layer of fluid heated from below, an arbitrary disturbance is expressed (in accordance with Fourier's theorem) as a superposition of two-dimensional periodic waves, and the stability is then investigated with respect to each of these waves.

III. THE SOLUTION OF THE CLASSICAL BÉNARD PROBLEM

As I have already stated, Rayleigh first gave the correct interpretation of Bénard's experiments. However, in solving the underlying mathematical problem, Rayleigh did not attempt to satisfy the correct (physical) boundary conditions. Later investigations by Jeffreys, Low, and Pellew and Southwell have corrected this deficiency in Rayleigh's original solution, so that we may now consider the problem as solved. I shall briefly describe the outcome of these investigations.

Rayleigh and, more generally, Pellew and Southwell have proved that for this problem the principle of the exchange of stabilities is valid and that, in agreement with the experiments, the onset of instability must manifest itself as a stationary pattern of motions. And the critical Rayleigh number for the onset of instability has been determined as follows:

Considering a horizontal two-dimensional periodic disturbance of an assigned wave number a ($= 2\pi/\lambda$ where λ denotes the wavelength of the disturbance) one asks: What is the lowest Rayleigh number $R(a)$ at which a mode of disturbance with the wave number a, when excited, does not get damped? On solving this problem, one finds that the resulting function $R(a)$ has a single minimum at $a = a_c$ (say) where $R = R_c$. It is clear that R_c specifies the required critical Rayleigh number for the onset of thermal convection, for if $R < R_c$, then all disturbances (expressible, as they are, as superpositions of two-dimensional waves) will be damped; and when $R = R_c$ all disturbances will again be damped *except* for a periodic disturbance with precisely the wave number a_c; this is, therefore, the disturbance which will manifest itself at marginal stability. In this manner the critical Rayleigh number for the onset of instability has been determined for the two cases of interest, namely, when the

layer of fluid is confined between two rigid planes and when the layer of fluid is supported by a rigid plane and the top surface is left free. The results of the mathematical analysis are:

$$\begin{array}{lll} \text{Both surfaces rigid} & R_c = 1708, & a_c = 3.13/d\,, \\ \text{Bottom surface rigid and the top surface free} & R_c = 1100, & a_c = 2.68/d\,. \end{array} \qquad (5)$$

Several experiments have been performed to verify whether or not instability does set in at the predicted Rayleigh numbers. I shall refer to only one such set of experiments, by Schmidt and Milverton, since the principle underlying their experiments is an important one and has provided the basis for other experiments to which I shall presently refer.

In the experiments of Schmidt and Milverton the layer of fluid was confined between two rigid planes which were maintained at constant temperatures, and heat was supplied (by an electrical coil) to the bottom plate at a constant rate. The experiments consisted in determining the difference in temperature, $(T_2 - T_1)$, between the two plates for varying rates of heating of the bottom plate; a measure of the latter is provided by the square of the heating current, C^2. Experiments of this kind generally give a plot similar to the one illustrated in figure 4. It will be seen that this plot shows a distinct break for a particular $T_2 - T_1 = \Delta T_c$ (say); this determines the critical temperature gradient, $\beta = \Delta T_c/d$ for the onset of instability. For, when $T_2 - T_1 < \Delta T_c$, the relation $(T_2 - T_1, C^2)$ is linear, with a constant slope corresponding to what must be (and is verified to be) the conductive temperature gradient; at $T_2 - T_1 = \Delta T_c$, the slope of the $(T_2 - T_1, C^2)$-relation suddenly decreases, indicating that after instability a new mechanism of heat transport – namely, convective heat transport – has begun to be operative. By such experiments Schmidt and Milverton were able to confirm that the critical Rayleigh number for the onset of instability for their experimental arrangement is 1770 ± 140; this is in good agreement with the theoretical value 1708 (cf. equation 5).

IV. THE EFFECT OF ROTATION

We shall now pass on to the consideration of the case when the layer of fluid which is being heated from below is set in rotation with a constant angular velocity Ω about the vertical. The effect of the

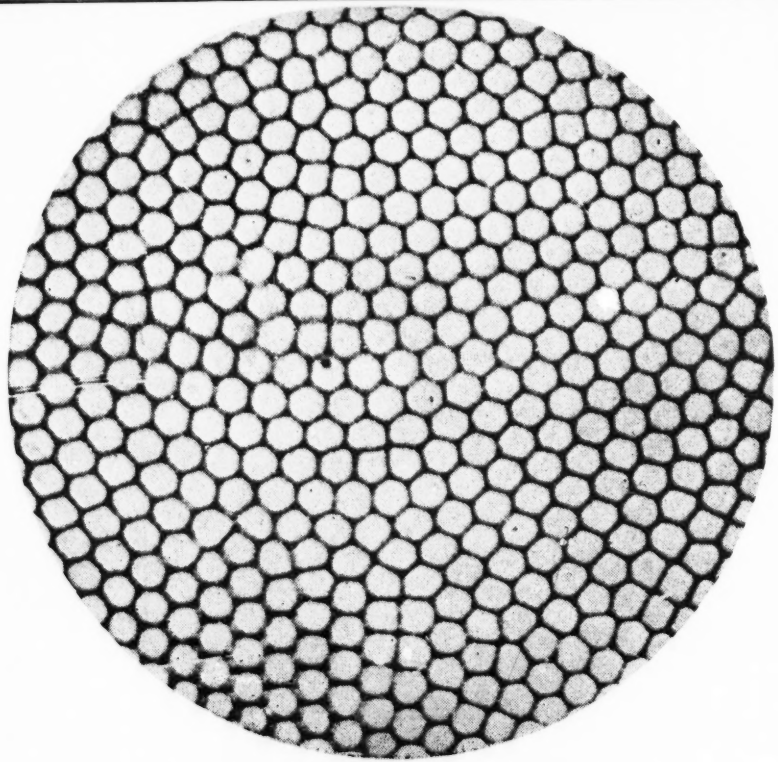


FIGURE 1. Bénard cells in spermaceti. A reproduction of one of Bénard's original photographs.

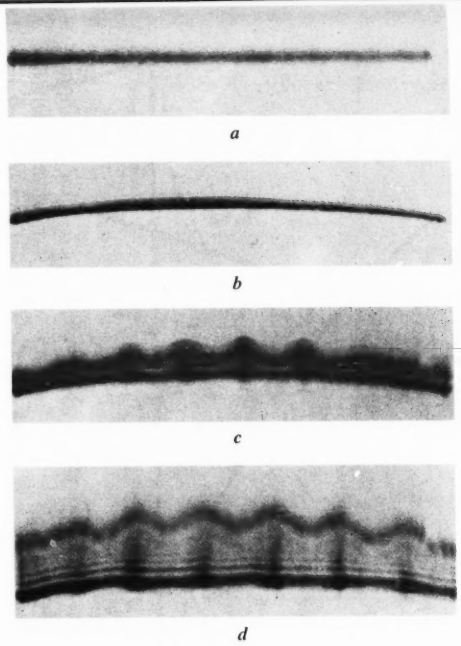


FIGURE 2. The onset of thermal instability as photographed by Schmidt and Milverton using an optical arrangement. (From *Proc. Roy. Soc.*, London, A, 152, 586, 1935.)

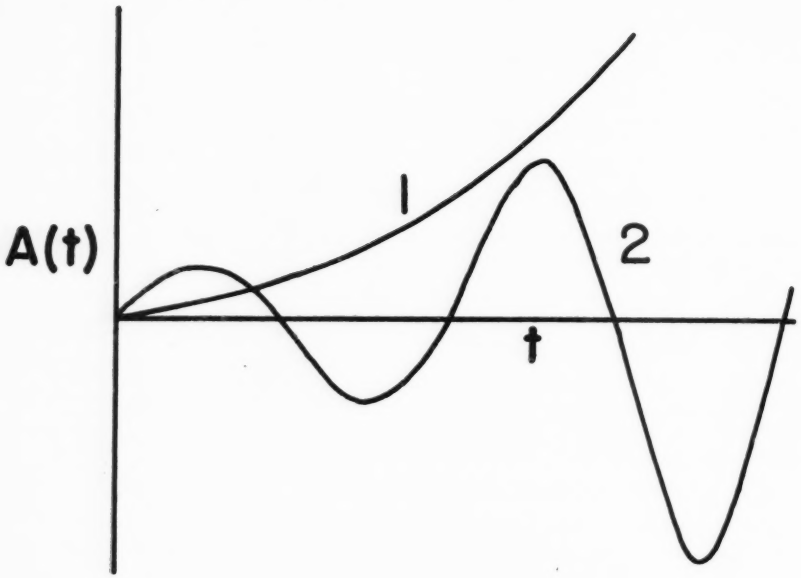


FIGURE 3. Aperiodic instability (curve 1) and overstability (curve 2).

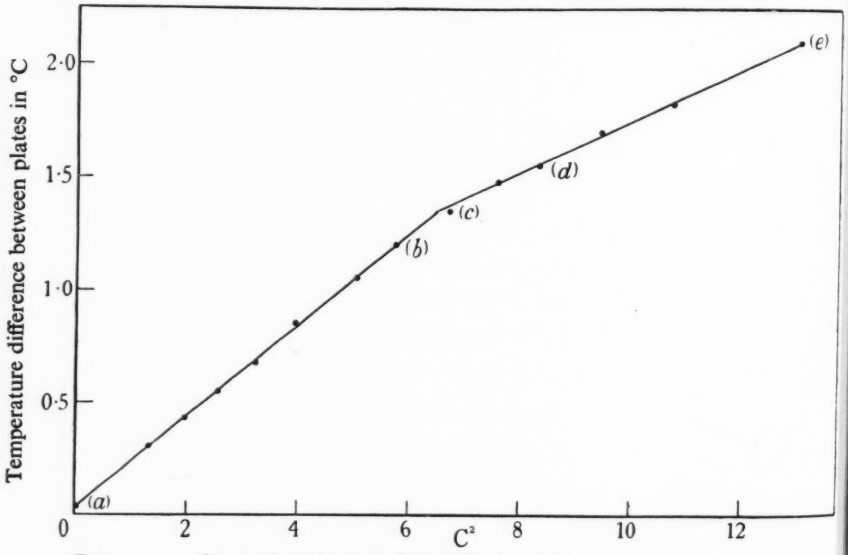


FIGURE 4. Curve showing the discontinuity in the rate of heat transfer in a layer of fluid between two horizontal plates when heated from below. (R. J. Schmidt and S. W. Milverton, *Proc. Roy. Soc.*, London, A, 152, 586, 1935.)

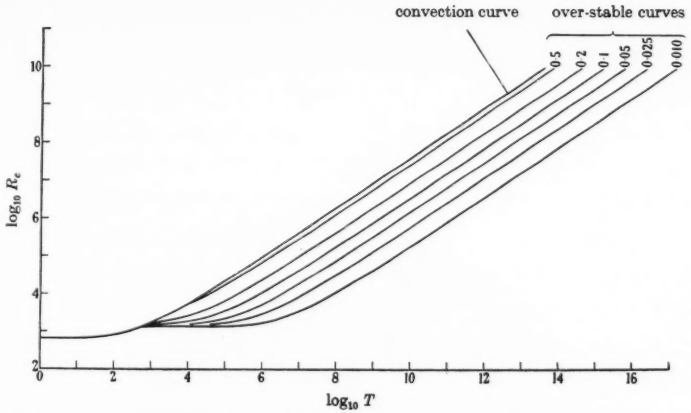


FIGURE 5. The (R_c,T)-relations for a rotating horizontal layer of fluid heated below. The curves have been derived for the case when both bounding surfaces are free. The curve labelled "convection curve" is the (R_c,T)-relation for the onset of ordinary cellular convection. The remaining curves are the corresponding relations for the onset of overstability. The value of ω to which the various curves refer are shown at the top of each curve. It will be seen that for each value of $\omega < 0.677$, the instability sets in as ordinary cellular convection for T less than a certain T^* while it sets in as overstability for $T > T^*$. (From *Proc. Roy. Soc.*, London, A, 231, 198, 1955.)

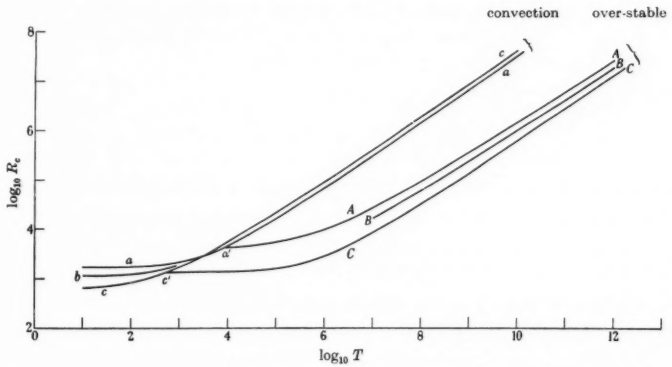


FIGURE 6. The (R_c,T)-relations for the three cases (a) both bounding surfaces rigid, (b) one bounding surface rigid and the other free, and (c) both bounding surfaces free. The curves labelled *aa*, *b*, and *cc* are the relations for the onset of ordinary cellular convection for the three cases, respectively. The curves labelled $a'AA$, BB, and $c'CC$ are the corresponding relations for the onset of overstability for $\omega = 0.025$. At a' (respectively c') we have a change from one type of instability to another as T increases. (From *Proc. Roy. Soc.*, London, A, 231, 198, 1955.)

FIGURE 7. Convection cells which appear in water when in rotation and heated from below: depth 18 cm.; difference in temperature 0.7°; rate of rotation 5.0 rpm; Taylor number 1.2×10^9. (Y. Nakagawa and P. Frenzen, *Tellus*, 7, 1, 1955.)

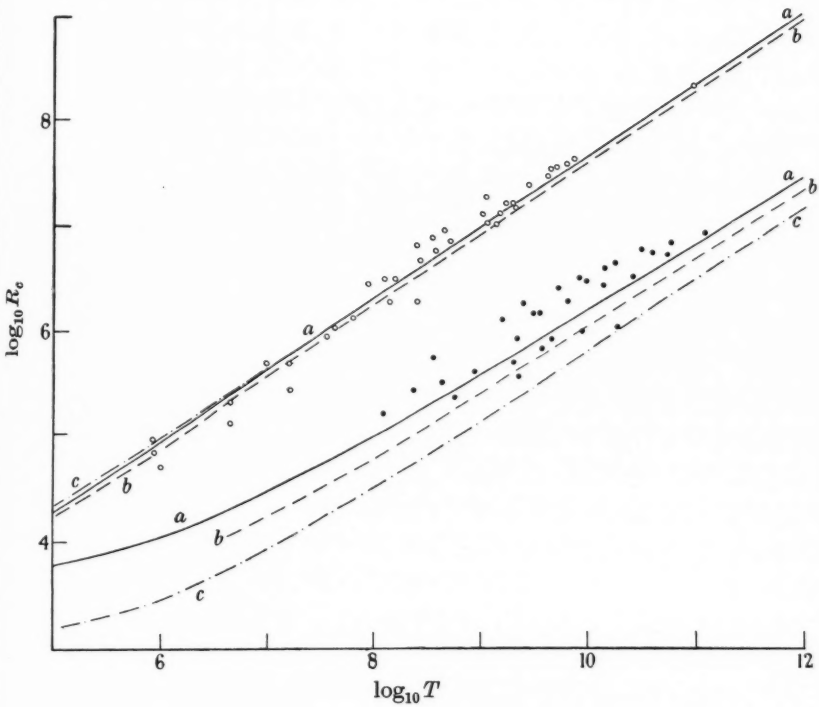


FIGURE 8. A summary of the experimental and the theoretical results. The curves *aa*, *bb*, and *cc* are the theoretical (R_c, T)-relations derived for the three cases (a) both bounding surfaces rigid, (b) one bounding surface rigid and the other free, and (c) both bounding surfaces free. The upper group of curves are for the onset of instability as ordinary cellular convection. The lower group of curves are for the onset of overstability for a value of the Prandtl number $\omega = 0.025$. The open circles are the experimentally determined points for water ($\omega = 6$). The solid circles are the experimentally determined points for mercury ($\omega = 0.025$). (D. Fultz and Y. Nakagawa, *Proc. Roy. Soc.*, London, A, 231, 211, 1955.)

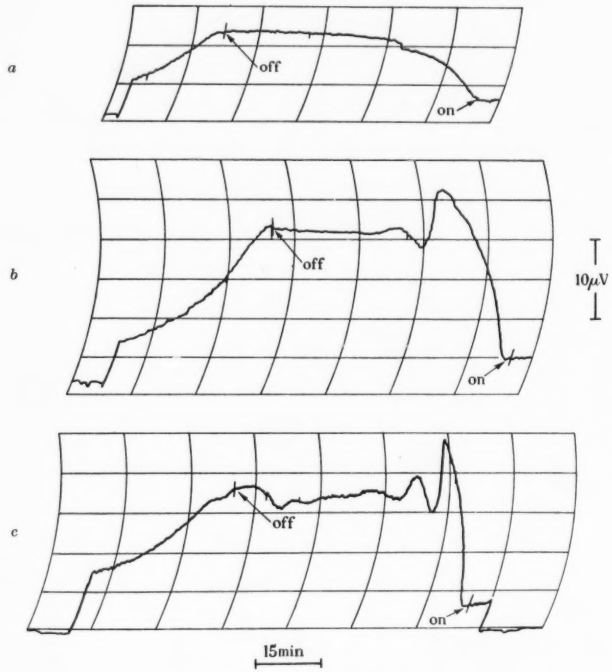


FIGURE 9. A time record of the adverse temperature gradient for water for three different rates of heating; $d = 3$ cm., $\Omega = 10$ rpm. (D. Fultz and Y. Nakagawa, *Proc. Roy. Soc.*, London, A, 231, 211, 1955.)

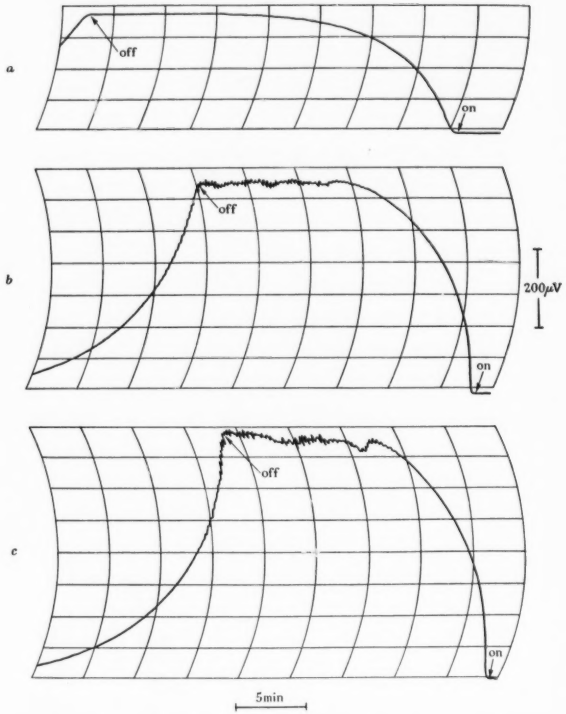


FIGURE 10. A time record of the adverse temperature gradient for mercury for three different rates of heating; $d = 6$ cm., $\Omega = 15$ rpm. (D. Fultz and Y. Nakagawa, *Proc. Roy. Soc.*, London, A, 231, 211, 1955.)

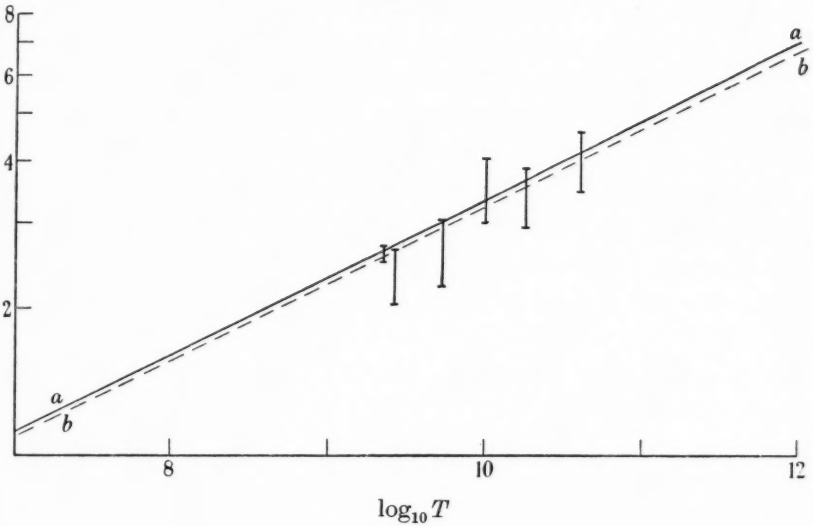


FIGURE 11. A comparison of the observed periods of oscillation at marginal stability with the theoretical periods. The ordinate (τ') gives the period in units of $2\pi/\Omega$. The curves *aa* and *bb* are the theoretical relations derived for $\omega = 0.025$ and for the case of two bounding surfaces rigid (*aa*) and one bounding surface rigid and the other free (*bb*). (D. Fultz and Y. Nakagawa, *Proc. Roy. Soc.*, London, A, 231, 211, 1955.)

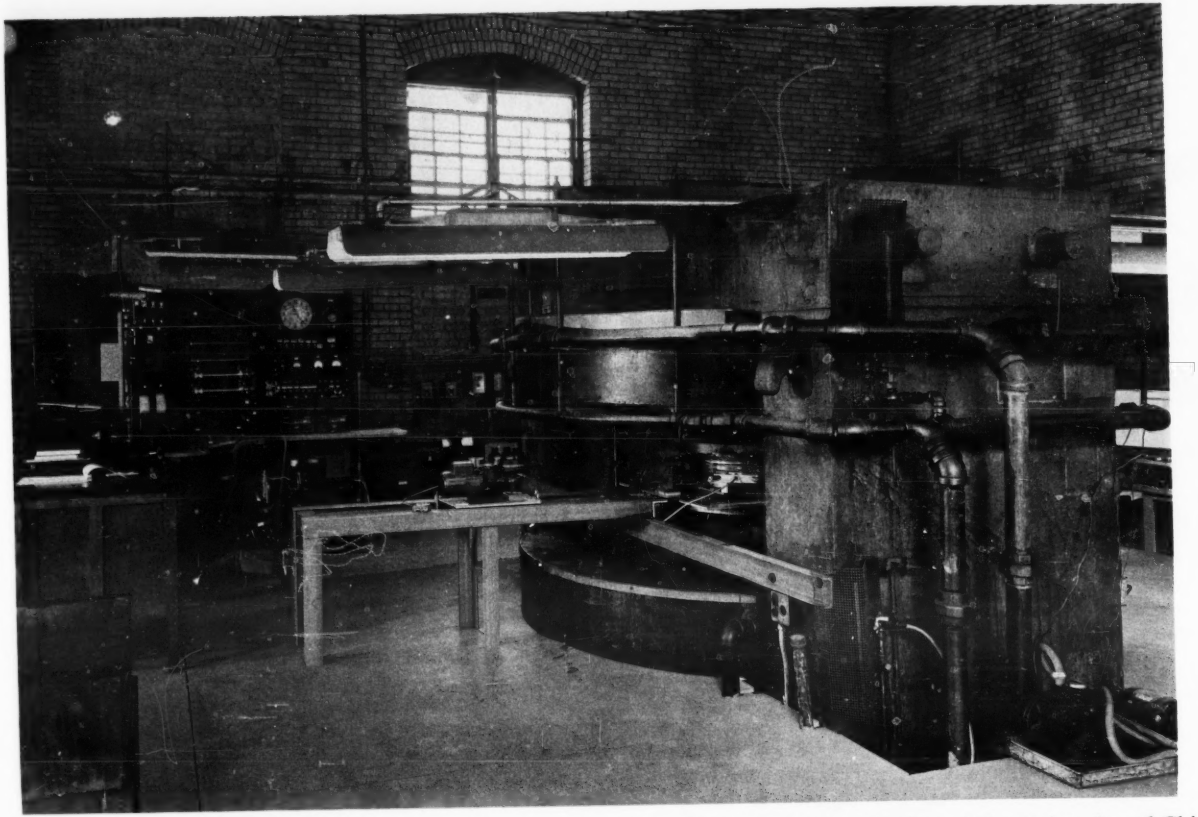


FIGURE 12. The hydromagnetic laboratory at the Enrico Fermi Institute for Nuclear Studies of the University of Chicago.

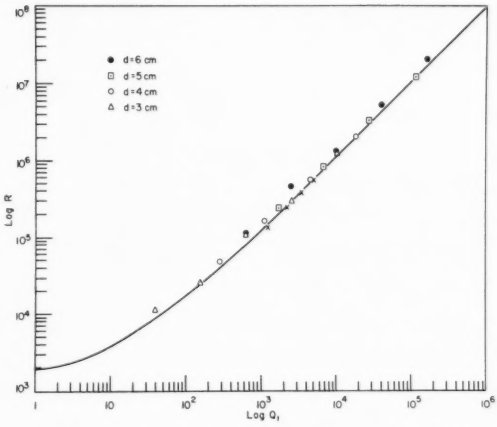


FIGURE 13. A comparison of the experimental and the theoretical results. The theoretical (R_c,Q_1)-relation is shown by the full line curve. The solid circles, squares, open circles, and triangles are the experimentally determined points for $d = 6$, 5, 4 and 3cm., respectively, with the 36½ inch magnet; the triangles represent the results with a smaller magnet with $H = 1500$ gauss and $d = 6$, 5, 4 and 3 cm. (Y. Nakagawa, *Proc. Roy. Soc.*, London, A, in press.)

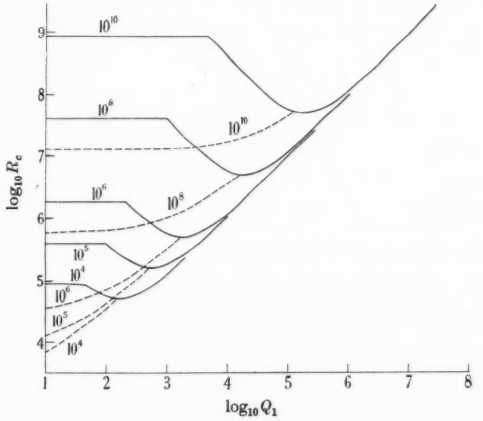


FIGURE 14. The critical Rayleigh number (R_c) for the onset of ordinary cellular convection (solid line) and overstability (for $\omega = 0.025$) (broken line) as a function of Q_1 $(= \mu^2 d^2 H^2 \sigma/\pi^2 \rho\nu)$ for various assigned values of T_1 $(= 4\Omega^2 d^4/\pi^4\nu^2)$. The curves are labelled by the values of T_1 to which they refer. For a given value of T_1, instability will set in as overstability for all values of Q_1 less than that at the point of intersection of the corresponding full line and dashed curves; for all larger values of Q_1, it will set in as ordinary convection. (*Proc. Roy. Soc.*, London, A, 237, 476, 1956.)

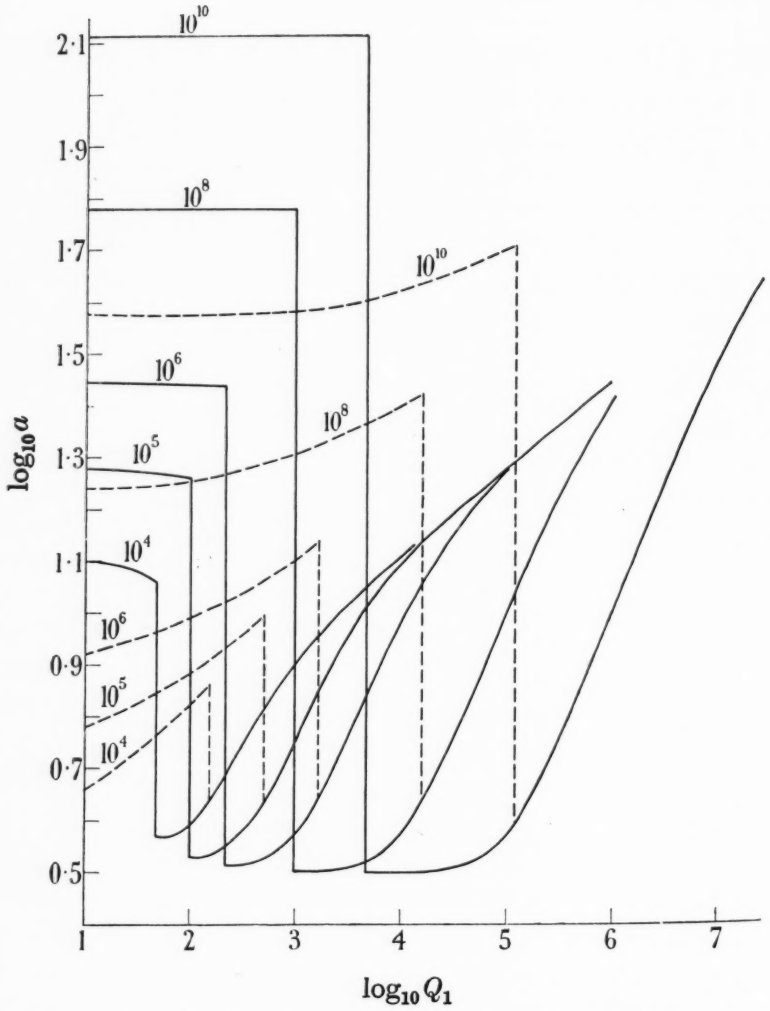


FIGURE 15. The dependence on Q_1 (for various assigned values of T_1) of the wave number a (in the unit $1/d$) of the disturbance at which instability first sets in as convection (solid line) and as overstability (for $\omega = 0.025$) (broken line). It will be observed that a discontinuous change in a occurs when (for increasing Q_1) the manner of instability changes from overstability to cellular convection. (*Proc. Roy. Soc.*, London, A, 237, 476, 1956.)

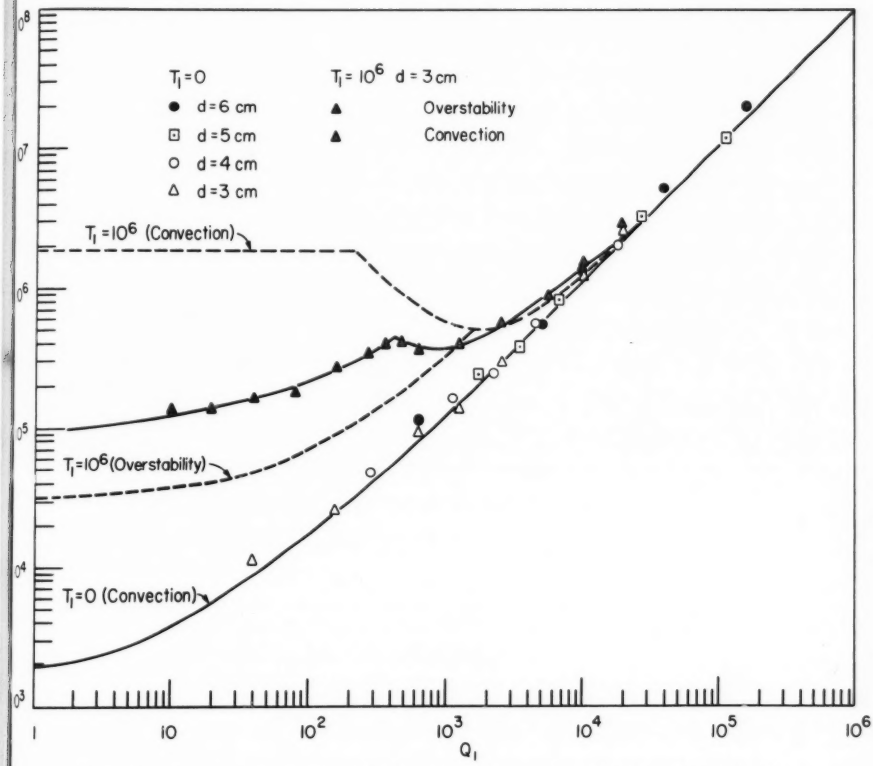


FIGURE 16. A summary of the experimental and the theoretical results. The curves labelled $T_1 = 10^6$ (convection), $T_1 = 10^6$ (overstability) and $T_1 = 0$ (convection) represent the theoretically derived relations. The value of T_1 appropriate for the experimental points represented by the solid and shaded triangles is 7.75×10^5.

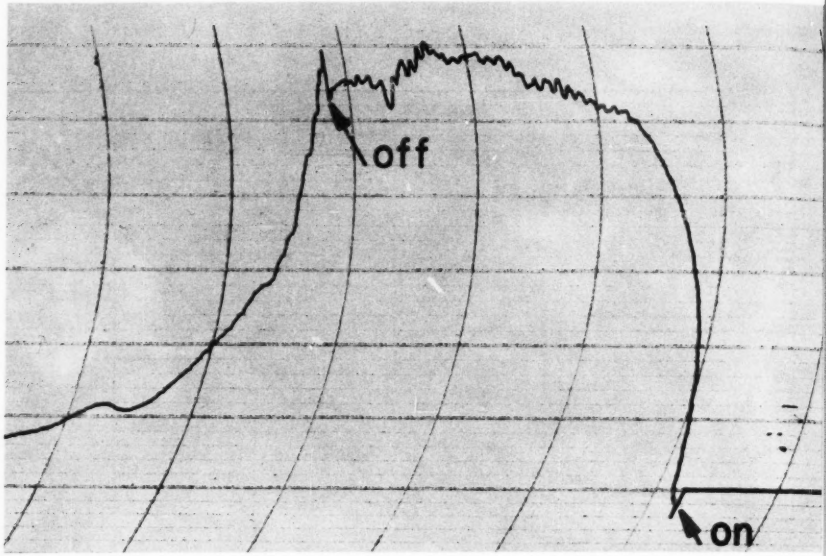


FIGURE 17. A time record of the adverse temperature gradient for mercury: $d = 3$ cm., $\Omega = 5$ rpm, $H = 125$ gauss, $Q_1 = 1.01 \times 10^1$, $T_1 = 7.90 \times 10^5$.

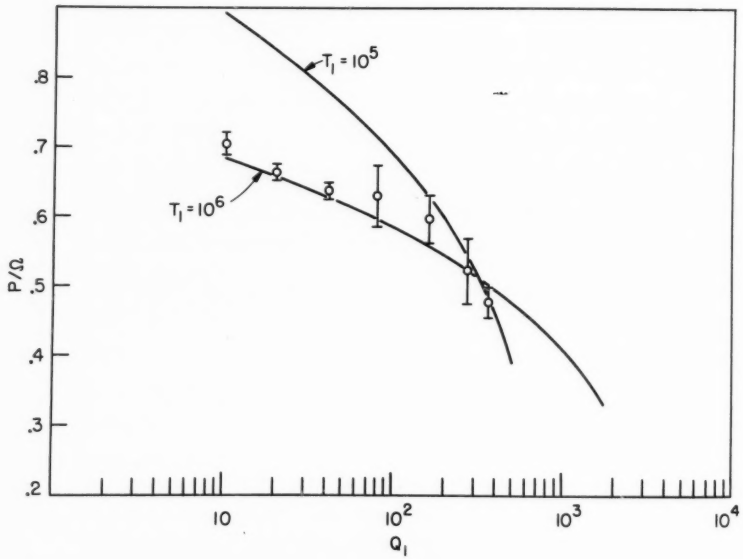


FIGURE 18. A comparison of the observed periods of overstable oscillations with the theoretical values (the full line curves). The value of T_1 appropriate for the experimental results is $(8.05 \pm 0.07) \times 10^5$.

rotation is to subject the fluid to Coriolis acceleration in addition to that of gravity. And Coriolis acceleration can have a decisive effect on the onset of instability, as can be seen from the following argument:

In the absence of viscosity and temperature gradients, the equations governing the motions of the fluid are:

$$\frac{\partial \boldsymbol{u}}{\partial t} + (\boldsymbol{u}.\, grad)\boldsymbol{u} = -\, grad\, P + \; 2\boldsymbol{u} \times \Omega \tag{6}$$

and
$$div\, \boldsymbol{u} = 0, \tag{7}$$

where
$$P = -\tfrac{1}{2}\,|\Omega \times \boldsymbol{r}|^2 + p/\rho \tag{8}$$

In the foregoing equations $\boldsymbol{u}$ denotes the velocity, p the pressure and ρ the density.

If the state of motions is stationary, and the velocities are sufficiently small for the nonlinear terms in equation 6 to be negligible, then

$$grad\, P = 2\boldsymbol{u} \times \Omega \tag{9}$$

From this equation it follows that

$$curl\, (\boldsymbol{u} \times \Omega) = 0. \tag{10}$$

When Ω is assumed to be in the direction of the z-axis, the three components of the single vector equation (10) are

$$\frac{\partial u_x}{\partial z} = 0, \quad \frac{\partial u_y}{\partial z} = 0 \text{ and } \frac{\partial u_x}{\partial x} + \frac{\partial u_y}{\partial y} = -\,\frac{\partial u_z}{\partial z} = 0. \tag{11}$$

Hence, in the absence of viscosity, for sufficiently slow motions, the velocity components cannot depend on z. This result is a special case of a general theorem due to J. Proudman and G. I. Taylor that *all slow motions in a rotating inviscid fluid are necessarily two dimensional.* This theorem has an important bearing on the ensuing of thermal convection in a rotating fluid.* For, convection implies that the motions have a three-dimensional character; and this the Taylor-Proudman theorem forbids for an inviscid fluid so long as the nonlinear terms in the equations of motion are neglected. Accordingly, in contrast to the case of a nonrotating fluid, an inviscid fluid in rotation is thermally stable for *all* adverse temperature gradients.

*I am indebted to Dr. Raymond Hide for pointing out to me the relevance of the Taylor-Proudman theorem for these considerations.

Indeed, only in the presence of viscosity can instability arise, for only then can the Taylor-Proudman theorem be violated.

It is clear, then, that the effect of rotation will be to inhibit the onset of convection. More precisely, it follows from a theoretical analysis of this problem that the extent of the inhibition depends on Ω through the nondimensional parameter

$$T = \frac{4\Omega^2}{\nu^2} d^4 ; \qquad (12)$$

this has now come to be called the Taylor number.

A further important difference between the problem with and without rotation is the following: While in the problem without rotation the principle of the exchange of stabilities is always valid, this is no longer the case when Coriolis forces are acting. The discriminating parameter in this connection is the ratio of the kinematic viscosity (ν) to the thermometric conductivity (κ); this is sometimes called the Prandtl number and denoted by

$$\omega = \nu/\kappa . \qquad (13)$$

From a theoretical analysis of the problem it follows that if ω is less than a certain critical value ω^* (say), then for all values of T greater than a certain determinate T^* (depending on ω), the mode of instability which should set in first is overstability and not convection. But if $\omega > \omega^*$, the principle of the exchange of stabilities obtains and instability should set in as ordinary cellular convection. The type of results to be expected under these circumstances is shown in figure 5. The precise value of ω^* depends on the boundary conditions that have to be satisfied on the confining boundaries (such as whether they are rigid or free). For the (nonphysical) case of two free boundaries $\omega^* = 0.677$; the exact value of ω^* for other more realistic boundary conditions has not been determined; but it is known that in all cases it is not very different from unity.

It is remarkable that the Prandtl number should play this decisive role in determining the manner of the onset of thermal instability in rotating fluids; and that overstability should be the rule for $\omega \ll 1$, as is the case with metallic liquids such as mercury.

(*a*) *Theoretical Predictions*

The results of the theoretical calculations on the dependence of R_c on T are shown in figure 6. The cases when instability sets in as

a stationary pattern of convection as well as when it sets in via a state of oscillatory motions are both illustrated; in the latter case the curves refer to a value of $\omega = 0.025$ which is appropriate for mercury at room temperatures. The asymptotic behaviors of these dependences for $T \to \infty$ may be noted.

In case the instability sets in as convection, the dependence of the critical Rayleigh number for the onset of instability on the Taylor number T has the asymptotic behavior,

$$R_c \to \text{constant} \times T^{\frac{2}{3}} \qquad (T \to \infty); \tag{14}$$

while the wave number a_c (in units of $1/d$) of the disturbance which manifests itself at marginal stability increases with T according to the law

$$a_c \to \text{constant} \times T^{\frac{1}{3}} \qquad (T \to \infty). \tag{15}$$

These relations apply so long as ω is greater than a certain critical value ω^*. If the Prandtl number is less than this critical value, then for all T greater than a certain determinate value, instability will set in as overstability; and for sufficiently large T, we have the asymptotic relations:

$$\left.\begin{aligned} R_c &\to \text{constant} \times \frac{\omega^{\frac{1}{2}}}{(1+\omega)^{\frac{1}{2}}} T^{\frac{2}{3}}, \\ a_c &\to \text{constant} \times \left(\frac{\omega}{1+\omega}\right)^{\frac{1}{2}} T^{\frac{1}{3}}. \end{aligned}\right\} \quad (T \to \infty). \tag{16}$$

Also, the frequency, p, of the characteristic oscillations at marginal stability has the behavior,

$$p/\Omega \to \text{constant} \times T^{-\frac{1}{3}} \qquad (T \to \infty). \tag{17}$$

(*b*) *Experimental Verifications*

The various predictions described in the preceding paragraph and exhibited in figure 6 have been fully confirmed by some very beautiful experiments of Nakagawa and Frenzen and of Fultz and Nakagawa at the University of Chicago.

First, the experiments of Nakagawa and Frenzen with water (which has a Prandtl number $\omega = 6.0$) fully confirm that in this case, thermal instability does indeed set in as cellular convection (see figure 7) and that the $T^{\frac{2}{3}}$-law is obeyed (see figure 8). On the other

hand, the experiments of Fultz and Nakagawa with mercury (which has a Prandtl number $\omega = 0.025$) show that in this instance, in agreement with theoretical prediction, instability does set in as overstability. This is shown in a particularly striking manner by the temperature records (see figures 9 and 10 in which the temperature records obtained in the experiments with water and mercury are contrasted). Further, the experimentally determined (R_c, T)-dependence is in accord with the theoretical relation (see figure 8). And, finally, the frequencies of the characteristic oscillations at marginal stability (as determined from temperature records such as those shown in figure 10) are also in very good agreement with the predicted values (see figure 11).

V. THE EFFECT OF A MAGNETIC FIELD

We now turn to the effect of an impressed magnetic field on thermal instability. We suppose that the fluid under consideration is an electrical conductor (such as mercury) and that an external magnetic field ($\boldsymbol{H}$) is impressed in a direction parallel to gravity, $\boldsymbol{g}$. (The case when the directions of $\boldsymbol{H}$ and $\boldsymbol{g}$ are not parallel has also been treated; but we shall not consider it here.)

On general grounds we may expect that the effect of a magnetic field will also be to inhibit the onset of convection and that the inhibiting effect will be the greater the stronger the magnetic field (H), and the higher the electrical conductivity (σ): for, when the field is strong (or the conductivity high) the lines of magnetic force tend to be glued to the material and this will make motions at right angles to the field difficult. In this latter respect the inhibiting effect of a magnetic field has a different origin from that of rotation: for, while in the absence of viscosity motions parallel to the axis of rotation are forbidden (in accordance with the Taylor-Proudman theorem), in the absence of electrical resistivity motions perpendicular to the field are forbidden.

As to whether instability will set in as convection or as overstability, it can be shown that with liquid metals such as mercury overstability cannot arise. Moreover, when cellular convection sets in, we must in accordance with what we have stated, expect that the cells become progressively elongated as the strength of the magnetic field is increased. And in the limit of infinite electrical conductivity (or, infinite field strength) when the fluid elements are

permanently attached to the lines of force and motions parallel to the field are the only ones permissible, convection in the usual sense cannot occur.

(a) Theoretical Predictions

A detailed theoretical treatment of the inhibition of thermal convection by a magnetic field confirms one's general expectations. Precisely, it is found that the critical Rayleigh number, R_c, for the onset of instability depends on the strength of the magnetic field (H) and the electrical conductivity (σ) through the nondimensional parameter

$$Q = \frac{\mu^2 H^2 \sigma}{\rho\nu} d^2, \tag{18}$$

where μ denotes the magnetic permeability (see figure 13). In particular it is found that the dependence of R_c on Q has the asymptotic behavior

$$R_c \to \pi^2 Q \qquad (Q \to \infty), \tag{19}$$

independently of the boundary conditions; and further that the wave number a_c (in units of $1/d$) of the disturbance which manifests itself at marginal stability has the behavior

$$a_c \to \pi^{\frac{2}{3}} (\tfrac{1}{2} Q)^{\frac{1}{3}} \qquad (Q \to \infty), \tag{20}$$

again, independently of the boundary conditions.

If we insert in the asymptotic relation (19) the expressions for R_c and Q given by equations 2 and 18, we obtain

$$\beta_c = \pi^2 \frac{\mu^2 H^2 \sigma \kappa}{g\alpha} d^{-2} \qquad (H^2\sigma \to \infty): \tag{21}$$

a formula for the critical temperature gradient in which the viscosity no longer enters. The physical meaning of this independence on viscosity is simply that as the strength of the impressed magnetic field is increased, ohmic dissipation – rather than viscous dissipation – becomes the principal factor in arresting incipient convection. Indeed, if we consider an *inviscid* fluid with a finite electrical conductivity, then we shall find that in the presence of an external magnetic field, the critical temperature gradient for the onset of instability is given precisely by equation 21. The presence of a magnetic field, therefore, imparts to the fluid characteristics which

we normally associate with viscosity; we may, if we like, even define an effective kinematic viscosity

$$\nu_{eff} = \frac{\mu^2 H^2 \sigma}{\rho} d^2, \qquad (22)$$

for motions perpendicular to the field.

(*b*) *Experimental Verifications*

Experiments on the inhibition of thermal convection by a magnetic field have been carried out by Nakagawa at the University of Chicago. For these and similar hydromagnetic experiments, the electromagnet of a (discarded!) 36½ inch cyclotron has been reconditioned at the Enrico Fermi Institute for Nuclear Studies at the university (see figure 12). This magnet provides a uniform magnetic field in a cylindrical volume 78 cm. in diameter and 22 cm. in height; and the strength of the field can be varied up to a maximum of 13,000 gauss. By using layers of mercury of depth 3 to 6 cm. and magnetic fields of strength 500 to 8,000 gauss, Nakagawa has determined the dependence of the critical Rayleigh number for the onset of instability on the parameter Q. The results of his experiments together with the theoretically predicted (R_c, Q)-relation are shown in figure 13. It will be seen that the experiments fully confirm the theoretical predictions.

(*c*) *The Magnetic Inhibition of Convection in Sunspots*

It is now generally believed that the lower temperatures of the sunspots relative to the surrounding photosphere is due to the absence of a convection zone in the sunspots at depths where convection is operative in the photospheric layers; and that this absence of convection in the sunspots is due to its having been suppressed by the prevailing magnetic fields. This suggestion was originally made by Walén and Biermann.

VI. THE EFFECT OF ROTATION AND MAGNETIC FIELD

We now consider the effect on thermal instability of a magnetic field and rotation acting simultaneously. From the physical interpretation which we have given of the effects which arise when rotation alone or magnetic field alone is present, it is clear that when they are both present, the fluid must be subject to conflicting tendencies.

For, while both have inhibitive effects on the onset of instability, the origin in the two cases is different. As we have explained, the inhibitive effect of rotation arises from the fact that in the absence of viscosity motions parallel to the axis of rotation are forbidden; while the inhibitive effect of a magnetic field arises from the fact that in the absence of electrical resistivity motions perpendicular to the field are forbidden. Consequently, when both rotation and magnetic field are present, motions compatible with the one are incompatible with the other. The fluid has therefore to obey two masters with contrary inclinations; and we may conclude that the fluid is in danger of a nervous breakdown! To express the same thing less anthropomorphically: The behavior of the fluid must be characterized by discontinuities indicating which of the two laws – the conservation of vorticity or the conservation of magnetic flux – is violated at the expense of the other (by virtue of viscous or ohmic dissipation).

An alternative way of looking at the problem is the following: We have seen that in the presence of rotation viscosity facilitates the onset of instability; we have also seen that a magnetic field imparts to the fluid characteristics associated with viscosity. Consequently, even though each acting separately inhibits the onset of convection, they will not necessarily conspire toward the same ends when they act together; indeed, we may expect that under certain circumstances the effect of a magnetic field on a rotating fluid may actually be one of accelerating the onset of convection.

We may look at the problem in still another way: In the absence of viscosity we have the theorem of Helmholtz and Kelvin that the normal flux of the vorticity ($\boldsymbol{\omega} = \text{curl}\, \boldsymbol{u}$) across any element of surface is an integral of the equations of motion; i.e.

$$\frac{d}{dt}\int_S \boldsymbol{\omega} \,.\, d\boldsymbol{S} = 0\,, \tag{23}$$

where the integral is over an element of surface S and we follow the element with the motion. At the same time, in the absence of electrical resistivity we have the theorem of Cowling that the normal flux of the magnetic field ($\boldsymbol{H}$) across any element of surface is also an integral of the equations of motion; i.e.

$$\frac{d}{dt}\int_S \boldsymbol{H} \,.\, d\boldsymbol{S} = 0\,. \tag{24}$$

It is the existence of these two integrals simultaneously that is at the base of the complex behavior of a real fluid (i.e. one with finite viscosity and finite electrical resistivity) when circulating and in the presence of a magnetic field.

(*a*) *Theoretical Predictions*

A complete theoretical discussion of the thermal instability of a layer of fluid such as mercury, in rotation and in the presence of an impressed magnetic field, is further complicated by the fact that the onset of instability in the presence of rotation is generally as overstability while it is as convection in the presence of a magnetic field. While the general solution of this complex problem taking correctly into account all the boundary conditions has not been carried out, the analogue of the case of two free boundaries (first considered by Rayleigh in his solution of the classical problem) has been fully analyzed and the results of the analysis are summarized in figures 14 and 15.

Considering first the case when instability sets in as convection, we observe that the following sequence of events will occur if we gradually increase the strength of the magnetic field keeping the angular velocity of rotation constant. Suppose for example that $T_1 \ (= T/\pi^4) = 10^5$ and we gradually increase the magnetic field; i.e., $Q_1 \ (= Q/\pi^2)$. When $Q_1 = 0$ (and $T_1 = 10^5$) the cells which appear at marginal stability will be elongated ($a/d = 18.9$); and as Q_1 is increased, at first, the critical Rayleigh number and the dimension of the marginal cells will be hardly affected. However, when the magnetic field has increased to a value corresponding to $Q_1 = 100$, cells of two very different sizes will suddenly appear simultaneously: one set, which will be highly elongated and the other set, which will be relatively quite wide; in fact, in this particular case the ratio of the two cell diameters is about 6. As the magnetic field increases beyond this value, the critical Rayleigh number will start decreasing and pass through a minimum; and eventually the effect of the magnetic field will predominate.

The sequence of events we have described will occur if the Prandtl number ($\omega = \nu/\kappa$) exceeds a certain value of the order of one. But if one considers a fluid such as mercury with a low Prandtl number, the occurrence of overstability (when the effects of rotation dominate) alters the situation. The sequence of events we may then observe can be directly read from figures 14 and 15. It is seen for

example from figure 14 that the transition from overstability to convection occurs at about the place where the convection curve passes through its minimum; and from figure 15 it is seen that this transition is accompanied by a substantial discontinuity in the wave number of the disturbance which manifests itself at marginal stability. This latter discontinuity is in the sense that the convection cells (for increasing Q_1) suddenly become very much widened; under experimentally realizable conditions this widening can be by a factor as large as 10.

(*b*) *Experimental Verifications*

Again at the Fermi Institute, Nakagawa has carried out experiments on the thermal instability of rotating layers of mercury in a homogeneous external magnetic field. The results of his experiments are presented in figures 16 to 18.

Nakagawa was able to distinguish whether the onset of instability is as overstability or as convection by examining the temperature records. Figure 16 is one of these temperature records; it shows in a very striking manner the onset of overstability. The experimentally determined critical Rayleigh numbers for $T_1 = 7.75 \times 10^5$ and varying values of Q_1 are exhibited in figure 17 together with the theoretically expected relations for $T_1 = 0$ and $T_1 = 10^6$. It is seen that the transition from overstability to convection does occur, as predicted, at a certain critical field strength. However, the quantitative agreement between theory and experiment in this case is not as good as in the others; but this was not to be expected, since, in the solution of the theoretical problem in this case, the correct boundary conditions were not satisfied. Nevertheless, the experiments do confirm the broad features of the predicted variations; the agreement, in particular, between the observed frequencies of the oscillations at marginal stability and the predicted values is very satisfactory.

* * * * *

That the nonlinearity of the hydrodynamical equations leads to a complex and often unexpected behavior of a fluid is well known. If the fluid should in addition be an electrical conductor and magnetic fields are present, then its behavior contains even greater elements for surprise. It is this unexpectedness which makes hydromagnetics a fascinating field for study; but it also calls for a disciplined and a systematic examination.

In our efforts to understand why a fluid behaves in a particular way under particular conditions the study of hydrodynamic and hydromagnetic stability is likely to be useful, for it may disclose the relative importance and sometimes the conflicting tendencies of the different forces and constraints which are kept dormant in the undisturbed state. Thus, the study of thermal stability in the context of the simplest problem already reveals several phases of fluid behavior which, in these connections, go to make for its complexity. A similar examination of other situations may give us further insight. To the critic who rightly points out that in these studies we are very remote from the conditions under which Nature presents her most extravagant displays, let me only say:

There is a square. There is an oblong. The players take the square and place it upon the oblong. They place it very accurately. They make a perfect dwelling place. The structure is now visible. What was inchoate is here stated. We are not so various or so mean. We have made oblongs and stood them upon squares. This is our triumph. This is our consolation.

—Virginia Woolf

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Count Rumford Discovers Thermal Convection

SANBORN C. BROWN

WHEN dining, I had often observed that some particular dishes retain their heat much longer than others, and that apple pies and apples and almonds mixed (a dish in great repute in England) remain hot a surprising length of time.

Much struck with this extraordinary quality of retaining heat which apples appeared to possess, it frequently occurred to my recollection, and I never burnt my mouth with them or saw others meet with the same misfortune without endeavoring but in vain to find out some way of accounting in a satisfactory manner for this surprising phenomenon.

About four years ago, a similar accident awakened my attention and excited my curiosity still more. Being engaged in an experiment which I could not leave, in a room heated by an iron stove, my dinner which consisted of a bowl of thick rice soup was brought into the room, and as I happened to be too much engaged at the time to eat it, in order that it might not grow cold I ordered it to be set down on the top of the stove. About an hour afterwards, as near as I can remember, beginning to grow hungry and seeing my dinner standing on the stove, I went up to it and took a spoonful of the soup, which I found almost cold and quite thick. Going, by accident, deeper with the spoon the second time, this second spoonful burnt my mouth. This accident recalled very forcibly to my mind the recollection of the hot apples and almonds, with which I had so often burnt my mouth a dozen years before in England. Even this, though it surprised me very much, was not sufficient to open my eyes and to remove my prejudices respecting the conducting power of water.[1]

In this chatty style, Count Rumford began to describe in 1797 his discovery of the thermal current in fluids. His first observations of convection currents were accidental, as he watched the behavior of the contents of the bore of a large thermometer he was using in an experiment:

I saw the whole mass of the liquid in the tube in a most rapid motion running swiftly in two opposite directions, up and down at the same time. The bulb of the thermometer, which is of copper, had been made two years before I found leisure to begin my experiments, and having been

left unfilled without being closed with a stopple, some fine particles of dust had found their way into it and these particles which were intimately mixed with the spirits of wine, on their being illuminated by the sun's beam, became perfectly visible . . . and by their motions discovered the violent motions by which the spirit of wine in the tube of the thermometer was agitated. . . . On examining the motion of the spirits of wine with a lens, I found that the ascending current occupied the axis of the tube and that it descended by the sides of the tube. On inclining the tube a little, the rising current moved out of the axis and occupied the side of the tube which was uppermost, while the descending currents occupied the whole of the lower side of it.

The Count recognized that he had made a discovery of the first magnitude, and he correctly assigned the thermal motions to the changes in density of the fluid as a result of heating. The hot liquid, being lighter, tended to rise and the heavier liquid, which was cold, fell, and thus the currents could be separated into a continuous motion. To dramatize the experimental observations of these currents, he designed equipment which was easily constructed and could show the currents in a simple fashion.

Looking through the tables of specific gravity, he noticed that amber had almost the same density as that of water. Therefore, he reasoned, if he mixed ground-up amber with a solution of salt water, whose density was carefully adjusted so that the amber would be suspended in the liquid, he would have a device to demonstrate this effect. On heating of the bulb of the instrument, either by a candle or by one's hand, the currents set up could easily be seen in the motion of the amber particles. Not only was the Count's scientific reputation greatly enhanced by his discovery of thermal currents, but the apparatus he invented to show it became standard for many years afterward as a classroom demonstration of the convection effect.

Another piece of equipment which Rumford designed and about which he became very enthusiastic was used in a similar demonstration in which the suspended amber particles were held between two glass panes separated by about an inch of liquid. The panes were mounted directly in the mullions of a window, so that the outside pane was cold, at least in winter, and the inside was warm from the heat of the room. The suspended particles were then in perpetual motion and became a center of attraction for visitors to observe. Rumford found this device tremendously exciting:

I discovered horizontal currents running in opposite directions, one above the other, or regular winds which, springing up in the different regions of this artificial atmosphere, prevailed for a long time with the utmost regularity, while small particles of the amber collecting themselves together, formed clouds of the most fascinating forms, which being carried by the winds, rendered the scene perfectly fascinating! It would be impossible to describe the avidity with which I gazed on these enchanting appearances. In the state of enthusiasm in which I then was, it really seemed to me that Nature had, for a moment, drawn back the veil with which she hides from mortal eyes, her most secret and most interesting operations, and that I now saw the machinery at work by which winds and storms are raised in the atmosphere! Nothing seemed to be wanting to complete this bewitching scene and to give it the air of perfect enchantment, but that lightning in miniature should burst from these little clouds and that they were frequently so thickened up and had so much the appearance of preparing for a storm, that had that event actually taken place, it could hardly have increased my wonder and ecstasy.

For all the Count's enthusiasm about this piece of apparatus, we know that it only lasted three weeks, for he mentions in a footnote that "an end was put to the experiment by an accident, the box being broken by the carelessness of a servant, shutting the window shutter."

The immediate scientific result which Rumford set out to investigate was whether the transmission of heat in fluids was solely by means of convection currents in which heated fluid was moved bodily from one place to another or whether there was, in addition, a conduction of heat similar to that known to be operating in solids. He devised an elaborate series of experiments to determine the conductivity of liquids in which the thermal motion was interrupted, either by the changes in viscosity of the liquid or by mechanical means such as fibers in filters of various sorts. To carry out these investigations, he designed what he calls his "cylindrical passage thermometer." The thermometer bulb was mounted in a brass tube in such a way that it did not touch the outer wall of the brass tube. Material to be studied was packed between the thermometer tube and the outer wall. His method of using the device was to surround the thermometer bulb with the material to be tested and then place the whole instrument in ice water until the thermometer fell to 32°F. He then removed the instrument from the ice water and plunged it into boiling water and measured the length of time that it took the thermometer to pass from 40°F. to 60°F. This became a

standard temperature differential by which he could rate various substances to be measured.

> Having still fresh in my memory, the accidents I had so often met with in eating hot apple pies, I was very impatient when I had completed this instrument to see if apples which, as I well knew, are composed almost entirely of water, really possess a greater power of retaining heat than that liquid when it is pure or unmixed with other bodies.

As he suspected, he found almost immediately that the passage of heat through stewed apples took much longer than the passage of heat through water, as measured by his instrument. The Count then measured the amount of fibrous material in stewed apples as compared with the amount of water, and substituted for the apple fibers an equivalent amount of eiderdown. He discovered that the passage of heat through his cylindrical passage thermometer gave the same time reading in either case. He then decreased the amount of eiderdown and showed that the amount of heat which was transmitted through the fluid in a given time increased as the ratio of eiderdown to water decreased. He reasoned that if he could decrease the internal motions of the water to zero, the conductivity of the liquid would also be zero, and he therefore stated this extrapolation as a conclusion of his experiments.

It was not until 1834 that the well-known William Prout, writing in one of the *Bridgewater Treatises*, suggested:[2]

> There is at present no single term in our language employed to denote this mode of propagation of heat; but we venture to propose for that purpose the term *convection* (*convectio*, a carrying or converging), which not only expresses the leading facts, but also accords very well with the two other terms [conduction and radiation].

Even after this name was suggested, it took twenty years for *convection* to find its way to the universal acceptance which the term now enjoys.

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Anthropology and Film

Robert Gardner

I

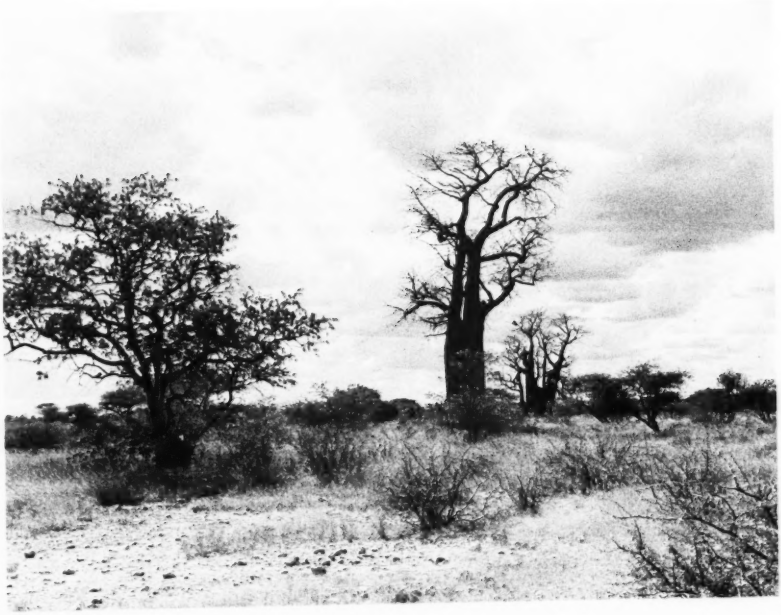
Anthropology is the study of humanity, involving all matters personal, social, and cultural. It can begin anywhere, with someone at prayer or the prayer itself, with hunger or a poisoned arrow. However, it is always necessary, at some point in this study, to observe the enactment of human life as it freely and naturally occurs. Such observation is for the purpose of collecting facts and noting impressions about human behavior, adding, as it does, to a pool of information from which inferences may be drawn and explanations offered.

Direct observation is, perhaps, the most basic and indispensable method by which man is investigated, and yet its practice asks almost more of human vision than it is reasonable to expect. The anthropologist-observer must not only verify by watching, he must also retain in memory or render into words an account of what he sees. He has been obligated to use his eyes as part of a system that produces as well as confronts the very realities he would understand. Apparently, since man must be known through being closely observed by another of his own kind, by a creature with the same basic characteristics and potentialities, the success or failure of anthropology is largely a question of the discriminative power of each investigator.

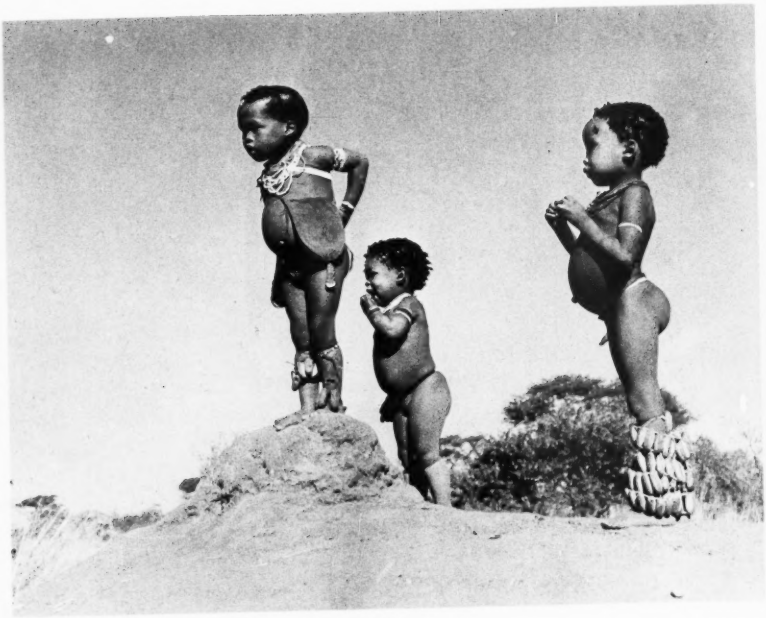
At least two characteristics, fundamental to all people, help distinguish human beings from every other manifestation of nature. The first is a capacity for putting meaning into the reality apprehended by the senses. This faculty for making reality meaningful, for experiencing with feeling all acts and events, is the basis upon which a person conceives thought or expresses himself through behavior. Moreover, it is by its influence that he is privately motivated. Man feels and perceives the world as it exists both within and around him, and, with the help of feelings and perceptions, he makes his responses to it.

The second characteristic is a capacity for being responsive to the meaningfulness of each other's behavior, either of deed or of

The Hunters



The Seasons



The Players

The Gatherers

The Rhythms

Mrs. Lawrence Marshall making ethnographic observation of a children's musical game.

John Marshall, principal cinematographer on three expeditions.

The Expedition in the Desert

thought. Human experiences are shared because their meaning can have currency as well as individuality. It is this which makes possible the unity of humanity, despite the fact that all its members are separately motivated. People, even though motivated within themselves by a faculty which ascribes meaning to everything they perceive, can still accept and share a meaning which arises through the working of the same faculty in other people, and then act, as so often happens, in sympathy.

For anthropologists to be able to grasp more fully the meaning of the lives of people they would observe, and, hence, achieve a better understanding of them, their sight requires immense discernment and penetration. To be sure, they are already endowed with the faculties of making reality meaningful to themselves and of sharing the meaningfulness of other people's lives. This is no more than to say they are human. But it is also human to perceive faultily much that is visible. It is difficult, even for anthropologists, to cross language and cultural boundaries without prejudice to their vision. The eye is the principal bridge in all such crossings and also the first opening through which reality must go to reach a human center and become perception, a bridge and opening with neither reliability nor consistency. In fact, it is almost a commonplace that sight is a selective process, that we see as much what we wish to see as what is held before our gaze. If it is necessary, for the sake of continuing anthropological research, to depend on such an inexact means of access to information, it should be worth considering possibilities for giving it some correction or support.

It is with this in mind that the Film Study Center of the Peabody Museum at Harvard University was conceived. Here, it was thought, could begin one attempt to provide assistance to the "seeing" of human life; and here, it was hoped, the kind of sight which the cine camera provides could be meaningfully shared by making it possible for people to see each other through its eye.

It has been suggested that the anthropologist's eye is part of a documenting as well as an interpreting system, that it makes pictures of human events which, by passing through memory, become the evidence upon which an explanation of those events can be offered. Cinematic recordings of human life are unchanging documents providing detailed and focused information on the behavioral characteristics of man. Although the camera is capable of great selectivity, it can also be as open and inclusive as the physical limi-

tations of man and machine will permit. There are many resources available to the anthropologist who would make observations cinematically. He has a choice of lens with which to make a subject smaller or larger, of camera speed so as to speed up or slow down the action observed, and of a type of film which will allow recording at virtually any time of day or night.

The most significant advantages of cinematic documentation are that the evidence provided is available to the view of many individuals both immediately and for a period of several centuries to come and that this evidence is of a direct and unambiguous kind, being reality instantaneously captured and suffering no distortion due to faults of sight, memory, or semantic interpretation. These are the ways in which motion pictures can aid the investigative side of anthropology. However, beyond the collecting and pooling of factual data, there is the more significant challenge of gaining an understanding of these data, and it is in this relation to anthropology that film has its boldest promise.

It might be said that progress in the science of anthropology is dependent on first making and then communicating a sufficient number of discoveries concerning personal, social, and cultural realities. Realities refer to the phenomena which constitute the practically limitless universe of human behavior; discoveries refer to insights into their underlying function or significance. It has been suggested that at the root of behavior, and, therefore, beneath all the phenomena of interest to anthropologists, functions a faculty wherewith meaning is given to all sensory experience. That is to say, except for certain primary drives relating to such matters as hunger, sex, and vulnerability to pain, human behavior is never reflexive but instead depends on a process of evaluation, a sort of sizing up of reality by each individual in terms of his own total experience. It has also been suggested that this meaning-giving process provides the mainspring of human motivation, in that it permits man to think and act for himself. If anthropology is to be successful in understanding the nature of these processes, called here "perceptions," the real problem, once they are discovered, is to find a way of describing and, hence, communicating them. Before one suggests how film can be utilized in this connection, it might be wise to have a clearer picture of how the process itself works.

Cantrill, a psychologist, makes the following observation:

A perception may be defined as an implicit awareness of the probable consequence an action might have for us with respect to carrying out some purpose that has value for us. I believe that it is safe to say every perception is in itself a value judgment process . . . . in most of our perceptions, of course, this weighing process goes on quite unconsciously.

If it is true that every human act results from this weighing procedure and that whatever is said or done by any human being has meaning at least in terms of the perceptions of the sayer or doer, much could be gained by being able to describe these perceptions. I have said that two basic characteristics help define the human condition. These are that people must feel in order to act and that the acts and feelings of any one or number of people are comprehensible, perceptible, to all other people. In a sense the first makes possible human individuality, as, in the same, rather loose sense, the second makes possible an association or community between many individuals. Putting it somewhat differently, it could also be said that the critical faculty for each person's individuality is his capacity to experience the realities which he can sense, and that the critical faculty for each person's sociality is his capacity for sharing the experiences of his fellows. In respect to the latter, it is doubtful that it could exist if it were not also possible to say that in the lives of all human beings there are certain basic equivalences. People are alike physiologically and neurologically. They are alike, as well, in facing an inevitable sequence of realities having to do with physical and emotional development. People are born, flourish, and die. They all, in some way, love, hate, give joy, and grieve. The very fact of a human potentiality for sharing each other's feelings presupposes that some such basis of similarity underlies these feelings, despite the variety of their cultural expression.

It is, as yet, extremely difficult to discover and identify these feelings, even for the individual. It may be worth while, all the same, to exercise an advantage offered in people's capacity for sharing one another's experiences, remembering that an experience carries in it the feelings and meanings which brought it about. If it was possible, for example, to render a realistic account in film of some seemingly remote experience, these capacities might reasonably be expected to produce reactions in those who saw it which, in meaningfulness, had some approximation to the feelings of those to whom the experience actually belonged. Failing this, if the film narrative is uncompromisingly real and sufficiently expressive of the significance

of the experience it portrays, the audience will, at the very least, be made more deeply aware of the validity of what they witness. Its humanity will be confirmed.

Film, I submit, is a particularly fluent and resourceful means of describing perceptions. It is, in a sense, a way of "image-ing" life, and it can do this with directness and economy. It is in its economy, in fact, that the adage about the worth of pictures in words has its truest meaning. It is, of course, possible to convey most kinds of information far more rapidly with photography than with words. Yet, if pictures could only document a greater amount in less space and time, their value would never equal that of words. After all, it is with words, and with other written symbols, that most of human knowledge has been discovered, communicated, and preserved. Even films depend on words, either spoken or printed, to do what is not or cannot be done with pictures. It would be better to see what pictures do well, to find their special qualities, and to use them accordingly rather than to suppose, as is done so much in visual education, that it is only a matter of time before movies make books unnecessary.

I have said that the cine camera is capable of greater detail and accuracy than simple vision. I have also said that this is an advantage to anyone whose wish it is to secure a factual account of some phenomenon, whether it is the behavior of a man or of a sunset. It is obvious that there is, however, more to seeing people or even setting suns than this. Both phenomena exist in terms of meaning, and if more is sought than their stark reality, if the intention is to discover the identity of the relation of these phenomena with people, their meaning must also be made known. In the accuracy and detail of a photograph of these and many other types of phenomena, the first special attribute of film that I want to mention can be found. It is that of "intensity." "Intensity" is a quality which refers as much to form and structure as to content, and, paradoxically perhaps, it is because there is such a richness of content in photographs that form can emerge. This is quite different from the usual verbal instance. Many words, which are required to provide the mass of detail necessary for a factual account of some event, have a tendency to obscure the underlying structure or relationship between its parts. In film, though, the photographs which could illustrate the same event can re-create the reality of it so swiftly and convincingly that it becomes, as reality, relatively insignificant. The details are ab-

sorbed, they cease to distract, and one's perception of the event can move on to considerations that have more to do with its meaning. Obviously, meaning in human life has not escaped the notice of people because they could not make photographs. Great literary analysts of human behavior have been quite content to make their discoveries with words. However, I should like to suggest that these people, besides being exceptionally skillful at observation, have been equally gifted in making pictures with words, in actually "imagining" life. It is only because a systematic study of human behavior cannot be founded upon imaginings, though it should certainly be continually stimulated by the best of them, that film is a more promising consideration than the novel or poetry.

There is one other special attribute of film for which the space available at this time allows only brief mention. It is "plasticity." It refers to the flexibility and expressiveness of film construction, one might almost say grammar. This attribute, like "intensity," arises from similar causes. Because photography is so exhaustively descriptive, and because it carries conviction on this account, it is possible to maintain credibility while, at the same time, suggesting relationships of the various elements of any reality through an unreal manipulation of the pictures which relate the reality. The duration of time and the volume of space which some phenomenon in fact required can be ignored in film without weakening its validity. It can be seen, perhaps, that this is precisely what people do in their personal confrontation of reality. They see phenomena through a selective and often distorting eye, through a screen or mass of apperception composed of unique experience and cultural background, and fix on them feelings and meanings which precipitate a response. For the reason of its great similarity to the process of perception, found in its potentialities for seeing, resolving, and expressing almost any reality, film holds out considerable promise as a way of making human feelings better known.

Here, then, is the hope, already indicated, for the Film Study Center: that, after it has had the opportunity to document various wide contexts of human life, it can proceed to make from such documentation visual expressions of the meaningful parts of it, to be seen and shared by as many people as can be reached. It is, perhaps, not too much to hope that such glimpses of humanity will be accepted by many who see them, and that some, at least, will be able to exercise their sharing capacities to get meaning from them.

II

At present the Peabody Museum Film Study Center is embarked on a combined research and production project involving approximately 250,000 feet of 16 mm. color film (about five days and nights of screen time). This is a staggering amount of film even if it were not devoted to a single topic. It is certainly the most comprehensive film documentation of any primitive culture. The culture belongs to a group called !Kung Bushmen who inhabit the Kalahari Desert of South-West Africa and the Bechuanaland Protectorate. These people and their mode of life have been the subject of a field inquiry extending over a period of five years beginning in 1950. On four separate trips the Peabody-Harvard-Kalahari Expedition has spent a total of more than twenty-four months recording, filming, and interviewing.

The Film Study Center project involves the production, over the next three years, of between twenty and twenty-five distributable films. The entire series of twenty or more films will not exceed twenty-five thousand feet in length (screen time approximately twelve hours), which leaves nearly 90 per cent of the total footage unused, though available as part of the total record which will be indexed and put on file.

The research aspect of the film project is an investigation into stylistic consideration of the film medium itself. In this work interest will center on exploring and developing techniques which enhance both the record-making and expressive potentialities of film, particularly as they might affect the progress of anthropological and related studies.

It is probable that the series of Bushmen films will provide a fairly broad summary view of !Kung culture, though this is not an objective which is foremost in the minds of the project members. We have chosen, instead, five dominant aspects of this culture with the intention of making each the subject of a relatively long film, somewhere between sixty and one hundred minutes. Along with these five major films, we intend to make fifteen or twenty others which will be shorter and more narrowly conceived. These, varying in length between ten and thirty minutes, will carry through some of the subsidiary elements appearing in one or another of the longer films. The longer films are intended to portray individual personalities and to develop the significant culture emphases and outline. That is to say, they will attempt to deal with matters, on the

one hand, of personal motivation and character and, on the other, of cultural themes and ethos. The shorter films will concentrate on the detail and fuller rendering of certain parts of each of the five major aspects, which are chosen both for their cultural prominence and their expressiveness. In trying to select what is significant in the !Kung culture we sought those features which would provide the most revealing representation possible. It was never a question of finding how many aspects we might present, but, rather, how few, while remaining faithful to the image reflected in the whole body of film. The five major films will be on the following subjects: *The Hunters, The Gatherers, The Players, The Rhythms,* and *The Seasons.* It is not at all coincidental that these five subjects comprise: in the first three, the people (men, women, and children); their habits; and their environment. The major emphases and outline for any culture should embrace this much at least. It happens that men are hunters, women gatherers, and children particular kinds of players among the !Kung. The special skills and procedures involved in the expression of hunting, gathering, and playing in this culture will be given fuller treatment in the shorter films, while their significance and meaning will be explored in the longer films.

It is too early to define the contents of the films that will actually comprise this series. In the few months since the Film Study Center was started, there has been time to produce only one film, *The Hunters.** Other films have been roughed out; others, broadly conceived, and still others, scarcely considered.

It is difficult to do more than suggest the contents of a film even with the best of still photographs. The pictures included here might, however, convey some sense of the primitiveness of !Kung culture and, perhaps, an inkling of its equally striking complexity and dignity.

Whereas one picture must suffice here to indicate the contents of a long film such as *The Hunters,* the film itself comprises 110,880 pictures. Actually, it is in the handling, conceptually speaking, of this many pictures that the greatest difficulties in film-making arise. The separate pictures do not, in film, have an independent existence but, rather, tie together in developing and changing images and sequences of images. The expression of each image comes partly from its inherent pictorial value and partly through its association

*This is the film shown to the membership of the Academy in October, 1956.

with images which precede or follow it. A film is composed very much in the fashion of music, gaining its effect by virtue of combination and tempo. Its differences, of course, are more obvious than its similarities. Film is essentially visual and, hence, can communicate with a logic that is literal as well as conventional. In *The Hunters* one is informed explicitly on matters of fact. The poison is applied to a certain part of the arrow. The arrow is made and released in an easily discernible way. Film, by capturing a reality, can then demonstrate it. The selection of particular realities to demonstrate is, simply, to choose the evidence by which the intent of any film is argued. The intent of *The Hunters* was to reveal both the practice and the meaning of hunting in the !Kung culture. To provide knowledge of its practice was a matter of careful illustration, to convey understanding of its meaning a matter of discriminating composition. If it should be that either of these objectives has been to any extent realized, it is probably due to the successful mingling of the means of science and art, and there is much more to be said, in this regard, about the fruitfulness of film.

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[7] Term expires May, 1957. [8] Term expires May, 1958. [9] Term expires May, 1959. [0] Term expires May, 1960.

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Fellows

Total elected, 96

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Sydney Goldstein	Harvard University, Cambridge, Mass.
Maurice Haskell Heins	Brown University, Providence, R. I.
Lynn Harold Loomis	Harvard University, Cambridge, Mass.

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Walter Houser Brattain	Bell Telephone Laboratories, Inc., Murray Hill, N. J.
Bernard Taub Feld	Massachusetts Institute of Technology, Cambridge, Mass.
Gerald James Holton	Harvard University, Cambridge, Mass.
Henry DeWolf Smyth	Princeton University, Princeton, N. J.

SECTION 3 – *Chemistry* – 5

George Hermann Büchi	Massachusetts Institute of Technology, Cambridge, Mass.
Saul Gerald Cohen	Brandeis University, Waltham, Mass.
Albert Sprague Coolidge	Harvard University, Cambridge, Mass.
Herman Francis Mark	Polytechnic Institute of Brooklyn, Brooklyn, N. Y.
David Powell Shoemaker	Massachusetts Institute of Technology, Cambridge, Mass.

SECTION 4 – *Astronomy* – 1

Leo Goldberg	University of Michigan, Ann Arbor, Mich.

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Victor Paul Starr	Massachusetts Institute of Technology, Cambridge, Mass.
Henry Bradford Washburn, Jr.	Boston Museum of Science, Boston, Mass.
Harry Wexler	Weather Bureau, Washington, D. C.

SECTION 6 – *Engineering Sciences and Technologies* – 6

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Harold Eugene Edgerton	Massachusetts Institute of Technology, Cambridge, Mass.
Antoine Marc Gaudin	Massachusetts Institute of Technology, Cambridge, Mass.
Warren Max Rohsenow	Massachusetts Institute of Technology, Cambridge, Mass.
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Jordi Folch-Pi	Harvard Medical School, Waverley, Mass.
Oscar Hechter	Worcester Foundation for Experimental Biology, Shrewsbury, Mass.
Arthur Kaskel Solomon	Harvard University, Cambridge, Mass.

Section 2 — *Botany and Bacteriology* — 4

Vernon Irvin Cheadle	University of California, Davis, California
Ivan Mackenzie Lamb	Harvard University, Cambridge, Mass.
Frederick Campion Steward	Cornell University, Ithaca, N. Y.
Albert Franklin Yeager	University of New Hampshire, Durham, N. H.

Section 3 — *Zoology* — 4

Min-Chueh Chang	Worcester Foundation for Experimental Biology, Shrewsbury, Mass.
Charles Peirson Lyman	Harvard University, Cambridge, Mass.
Bryan Patterson	Harvard University, Cambridge, Mass.
Elizabeth Buckley Shull Russell	Jackson Memorial Laboratory, Bar Harbor, Maine

Section 4 — *Physiology and Experimental Psychology* — 6

Mary Agnes Burniston Brazier	Massachusetts General Hospital, Boston, Mass.
Dwight Joyce Ingle	Billings Hospital, Chicago, Ill.
Karl Harry Pribram	Institute for Living, Hartford, Conn.
Curt Paul Richter	Johns Hopkins University, Baltimore, Md.
Harold Schlosberg	Brown University, Providence, R. I.
Heinz Werner	Clark University, Worcester, Mass.

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John Englebert Dunphy	Harvard Medical School, Boston, Mass.
Joseph Marchant Hayman, Jr.	Tufts University School of Medicine, Boston, Mass.
Chester Morse Jones	Harvard Medical School, Boston, Mass.
William Gordon Lennox	Children's Hospital, Boston, Mass.
Joe Vincent Meigs	Harvard Medical School, Boston, Mass.
Reidar Fauske Sognnaes	Harvard School of Dental Medicine, Boston, Mass.
James Clarke White	Harvard Medical School, Boston, Mass.

CLASS III — Social Arts and Sciences — 30

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Carl Iver Hovland	Yale University, New Haven, Conn.
Robert Richardson Sears	Stanford University, Stanford, Calif.
Robert Winthrop White	Harvard University, Cambridge, Mass.

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Harold Adolph Freeman — Massachusetts Institute of Technology, Cambridge, Mass.
Alexander Gerschenkron — Harvard University, Cambridge, Mass.
Ben William Lewis — Oberlin College, Oberlin, Ohio
Guy Henderson Orcutt — Harvard University, Cambridge, Mass.
Robert Merton Solow — Massachusetts Institute of Technology, Cambridge, Mass.

Section 3 — *Political Science* — 1

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Section 4 — *Law* — 9

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Kingman Brewster, Jr. — Harvard Law School, Cambridge, Mass.
Charles Fairman — Harvard Law School, Cambridge, Mass.
William James Kenealy — Boston College Law School, Boston, Mass.
Eugene Victor Rostow — Yale Law School, New Haven, Conn.
Aaron Cecil Snyder — Supreme Court of Puerto Rico, San Juan, P. R.
John Varnum Spalding — Massachusetts Supreme Judicial Court, Boston, Mass.
Samuel Edmund Thorne — Yale Law School, New Haven, Conn.
Raymond Sanger Wilkins — Massachusetts Supreme Judicial Court, Boston, Mass.

Section 5 — *Administration and Affairs* — 10

Jaime Benítez — University of Puerto Rico, Rio Piedras, P. R.
Charles Eustis Bohlen — Moscow, U. S. S. R.
Chester Bowles — Essex, Conn.
Thomas Knight Finletter — New York, N. Y.
Francis Whiting Hatch — Batten, Barton, Durstine & Osborn, Inc., Boston, Mass.
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Morton Gabriel White — Harvard University, Cambridge, Mass.
Amos Niven Wilder — Harvard Divinity School, Cambridge, Mass.

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Myron Piper Gilmore	Harvard University, Cambridge, Mass.
Richard Hofstadter	Columbia University, New York, N. Y.
Ly[illegible] Townsend White, Jr.	Mills College, Oakland, Calif.

Section 3 — *Philology and Criticism* — 3

Herbert Dieckmann	Harvard University, Cambridge, Mass.
Edith Fishtine Helman	Simmons College, Boston, Mass.
Albert Bates Lord	Harvard University, Cambridge, Mass.

Section 4 — *Fine Arts and Literature* — 3

Morris Gilbert Bishop	Cornell University, Ithaca, N. Y.
Chiang Yee	Columbia University, New York, N. Y.
Ludwig Miës van der Rohe	Illinois Institute of Technology, Chicago, Ill.

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Total elected, 6

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Section 6 — *Engineering Sciences and Technologies* — 1

Sir Geoffrey Ingram Taylor	Royal Society, Cambridge, England

CLASS — II — Biological Sciences — 1

Section 4 — *Physiology and Experimental Psychology* — 1

Robert Marie Jules Constant Courrier	Collège de France, Paris, France

CLASS III — Social Arts and Sciences — 2

Section 4 — *Law* — 2

Sir Owen Dixon	Australian High Court, Melbourne, Australia
Francis Raymond Baron Evershed	London, England

CLASS IV — Humanities — 2

Section 1 — *Philosophy and Theology* — 1

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